

WIRELESS CHARGING AND POWER MANAGEMENT SYSTEM FOR ELECTRIC VEHICLES USING DUAL INVERTER DRIVES

SURAM NAVEEN¹, MR.S.RADHA KRISHNA REDDY²

¹Mtech Student, Dept of EEE, Holy Mary Institue of Technology & Science, Keesara, Bogaram, Telangana, India.

²ASSOCIATE PROFESSOR & CoE,I/c Principal, Dept of EEE, Holy Mary Institute of Technology & Science, Keesara, Bogaram, Telangana, India. Mailid: rkphd2012@gmail.com

ABSTRACT:

EVs are becoming more prevalent and there is a need for reliable, efficient, convenient charging technology. To remove the need for physical charging connectors and enhance safety, convenience and durability, a new solution has been developed, Wireless Power Transfer (WPT). The standard wireless charging systems, however, require additional power electronic converter, communication module and charger controller on the vehicle, increasing the weight, cost and complexity of the car. The objective of this project is to address these issues by designing an Integrated Wireless Charging Receiver for EV with Dual Inverter Drives and charge the vehicle's battery by utilizing the existing components in the drive train. The proposed system is open-winding electric motor, dual-inverter drive topology and wireless charging receiver. The traction inverter and motor drive electronics that already exist in the vehicle help to minimize the need for special on-board charging equipment. The architecture features an excitation compensated receiver coil, capacitors and diodes for efficient transfer of wireless energy with minimal switching losses, thermal stress and electromagnetic interference. Additionally, the design ensures high frequency charging currents are kept away from sensitive parts of the drivetrain, enhancing system reliability and efficiency. The proposed system is validated with simulation with 6.6 kW wireless charging system with an electric vehicle powertrain of 110 kW. The simulation results demonstrate the efficient power transfer, less hardware requirement, better energy utilization and maximum charging efficiency of 94.3% for separation distance between coils 200 mm. The designed integrated charging architecture is an economic, light-weighted and high performance solution for the next generation's electric vehicle charging applications.

Keywords: Electric Vehicles (EVs), Wireless Power Transfer (WPT), Integrated Charging System, Dual Inverter Drive, Traction Inverter, Open-Winding Motor, Contactless Charging, Power Electronics, Energy Efficiency, Battery Charging, Wireless Energy Transfer, Smart Mobility.

Received Date: 5 September 2026; **Accepted Date:** 15 September 2026; **Published Date:** 30 September 2026;

This is an open-access article distributed under the terms of the Creative Commons Attribution 4.0 International License (CC BY 4.0), which permits unrestricted use, distribution, and reproduction in any medium, provided the original author(s) and the source are properly cited.

1.INTRODUCTION

With the growing number of Electric Vehicles (EVs) being used, there is a growing demand for reliable, efficient and convenient advanced charging technologies. There are safety issues with conventional plug-in charging, and physical

connectors can wear out, be damaged by the environment, and break. Wireless Power Transfer (WPT) technology has been identified as a viable solution for contactless power transfer between the charging station and vehicle. Wireless charging offers convenience to the users, maintenance-friendly, and

operations safety. But, conventional wireless charging methods need extra onboard parts like rectifiers, power converters, communication modules and control circuits. All of these add to the price, weight and complexity of electric vehicles. Researchers have therefore turned their attention to integrating charging functions with existing drivetrain parts, to reduce hardware needs and maximise system efficiency. The use of systems with integrated charging technology has proven to be very promising, reducing system size and charging performance without compromising system reliability. Efficiencies, compactness and cost reduction are key design goals for modern EVs, and such developments are important. Integrated charging systems, which integrate charging and propulsion functions in a common architecture, can greatly enhance the feasibility and marketability of EVs [1, 2].

Inductive power transfer technology has also attracted a lot of interest in the field of wireless charging, as it allows for wireless transfer of energy between the charger and the vehicle without requiring any physical contact. Current wireless charging solutions tend to be less efficient, are more costly to install, and have greater hardware demands than traditional conductive charging systems. To address these challenges, the re-use of existing traction motor and inverter systems from existing EV powertrains has been investigated. The use of wireless charging receivers with drivetrain components eliminates the need for charging-specific electronic devices and enables multiple functions to be performed with the same power electronics. Two traction inverters and an open-winding motor configuration allow for greater flexibility in power conversion and energy management in dual-inverter drive systems. Simply using existing drivetrain hardware for charging can help lower the number of parts, switching losses, thermal stress and electromagnetic interference. In addition, as integrated wireless charging systems do not require complicated communication between the vehicle and the charging station, they are more reliable and less complicated. Dual-inverter based wireless charging system is highly interesting for

future EV applications due to these advantages [3] [4].

The project envisions an Integrated Wireless Charging Receiver for Electric Vehicles with Dual Inverter Drives, which integrates wireless charging technology and a dual-inverter drive system for EVs. The proposed architecture is based on the use of an open winding electric motor, compensated wireless receiver coil, dual traction inverters, and battery packs to enable battery charging without the need of a dedicated battery on-board charger. In order to maximize the utilization of the components and to guarantee high charging efficiency and reliable operation, the system is designed. The proposed system helps to eliminate high frequency charging currents from flowing through the more sensitive drivetrain components, thereby improving thermal performance and prolonging component life. A 110 kW EV powertrain is connected with a 6.6 kW wireless charging system to carry out simulation studies. The results show efficient power transfer, minimal hardware requirements, greater energy use, and charging efficiency of more than 94%. The proposed solution is compact, lightweight, cost-effective, and is suitable for next-generation electric vehicles (NEVs) and smart transportation systems. Hence, the combination of wireless charging technology with dual-inverter drives is a major step towards the advancement of EV charging infrastructure and the development of sustainable mobility [5, 6].

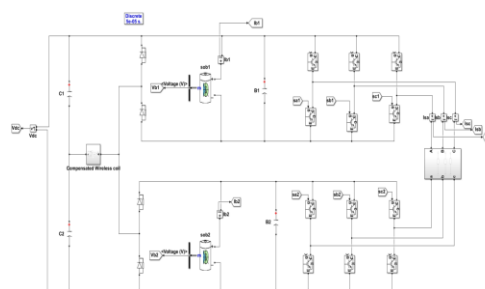


FIGURE 1. MATLAB/SIMULINK circuit diagram of the system

The proposed Integrated Wireless Charging Receiver for EV with Dual Inverter Drives is illustrated in MATLAB/Simulink model shown in Fig.1. The

model is the full wireless power transfer and battery charging system for the electric vehicle system. The wireless charging area is made up of a transmitter coil and a compensated receiver coil which allows for contactless transfer of energy via magnetic coupling. Compensation capacitors and diode arrangements are used to process the received AC power, ensuring efficient power transfer and voltage regulation. The receiver side is equipped with a dual-inverter drive system consisting of two traction inverters, dual battery packs and an open winding electric motor. The new system does not need to install new traction inverters for battery charging, instead it utilizes the existing ones to carry out a battery charging process. The cost of the system is lowered, the weight is reduced and the density of power is improved, since this integration helps in the reduction of additional power electronic components. The dual-inverter also offers flexible power flow control and improved charging performance. Charging characteristics, power transfer efficiency, voltage and current waveforms, battery charging behavior and overall system performance are analyzed using the MATLAB/Simulink model. The simulation results reveal that the integrated architecture can be operated in an efficient manner for wireless charging while maintaining minimum switching losses, thermal stress, and electromagnetic interference. Therefore, the proposed integrated wireless charger can be used as a small, reliable and efficient solution for the next generation electric vehicle charging applications.

II SURVEY OF RESEARCH

1. A comprehensive review of integrated charging systems for electric vehicles was presented by J. Gallardo-Lozano, E. Romero-Cadaval, M. I. Milanés-Montero and M. A. Guerrero-Martinez. The authors examined some of the charging topologies that involve existing propulsion parts (traction motor, inverter) as part of the charging circuit for the battery. Their research was aimed at minimizing size, weight and cost of on-board charging equipment, whilst retaining high charging efficiency. In the study, the integrated chargers were classified based on hardware utilization and control methods/power conversion architectures. The authors showed that the integrated charging systems can result in a much higher power

density and overall vehicle efficiency, without the need for a separate charging system. Issues that were recognized were electromagnetic compatibility, isolation requirements and complex control strategies. Last but not least, the research has been focused on the finalization of the concept of multifunctional power electronic converter as a suitable solution for future EV charging systems. The work presented in this thesis provides good background for the development of integrated wireless charging architectures which integrate charging and propulsion functions in one single system, which will lead to more reliable systems, and lower manufacturing costs.

2. S. Li and C. C. Mi had carried out extensive research in the field of wireless power transfer technologies for EVs. They learned about the various wireless power transfer technologies, compensation networks, coil designs and controllers used in wireless charging. The authors highlighted the advantages of a wireless charging system, including convenience for the user, operational safety, and reduced maintenance expenses. Different topologies of compensation were investigated to enhance the power transfer efficiency and reduce energy losses due to coil misalignment. The experimental tests have demonstrated efficiencies higher than 90% can be achieved at optimum operating point of a wireless charging system. There were, however, some problems of power density and electromagnetic interference and installation costs were also discussed. The authors highlighted the need to propagate the wireless charging elements to be able to interact with existing vehicle systems, thereby minimizing hardware complexity. Based on their findings they can devise effective wireless charging systems and can also be the basis for the creation of integrated wireless charging receivers that allow to benefit from existing drivetrain elements.

3. J. Park, H. Kim, S. Kwak, and S. Sul introduced a wireless charging system using the existing traction motor and inverter equipments for the charging of EV batteries. The proposed architecture reduced the requirement for specific charging equipment

onboard, and adds charging functionality to the drive train. The study proposed a novel control strategy to eradicate the high frequency current through the sensitive components of the motors to achieve high system reliability along with thermal stress reduction of the high frequency component. The charging efficiencies were shown to be over 94% at a coil separation distance of 200 mm with both simulation and experimental results. The research has raised the question of using traction inverters as charging converter (which does not affect good propulsion performance). The proposed solution led to a reduction of component count, system complexity and manufacturing costs. This is one of the most prominent papers in the field of integrated wireless charging systems and it has a direct impact on the methodology adopted for the design in the proposed project.

4. S. Dusmez and A. Khaligh discussed a compact multifunctional power electronic interface which can be employed for both propulsion and battery charging of plug-in electric vehicles. The architecture proposed used the components of a traction inverter to charge, eliminating the need for extra power conversion stages. The sharing of hardware resources led to greater power density, efficiency and lower manufacturing costs. The study focused on bidirectional power flow and advanced converter controls to enable smooth switchover between the charging and driving modes. The proposed design was tested and validated by simulation and experimental test results for various operating conditions. The authors proved that a platform incorporating several functions could greatly reduce the complexity of the EV architecture and enhance overall performance. The research laid the groundwork for many of the modern-day integrated charging systems, and all the way down to the idea of using dual inverter drives for wireless charging applications.

5. To leverage the existing operation principle of the integrated onboard charging system, H. Zhang, J. Feng and C. Chen developed a modified system that leverages the windings and inverter switches of the

traction motor system for battery charging. The proposed design was designed with both single-phase and three phase charging in mind, and only minor changes made to an existing powertrain structure. The researchers were trying to make use of the parts the best way as well as to minimise the need for additional parts. The transition between the propulsion mode and charging mode was smooth, with a complex control method applied. The charging efficiency, size of the system and its power density were compared with the traditional charging solutions and validated by experiments. The study was successful in showing that integrated charging systems can be used to achieve high reliability and performance at lower manufacturing costs. The findings are relevant for the development of complex wireless charging systems that are based on the power electronics already available in cars to deliver energy and charge to batteries.

6. A new type of dual-inverter drive integrated onboard charger was presented by K. Lee, S. Sul, and H. Kim who used an electric motor with open-winding. It employed two traction inverters for drive and charging the battery to make maximum use of the equipment. The authors showed such dual-inverter configuration led to system flexibility, reduction of the number of components, and high efficiency. The design required only a couple additional passive devices, and could be scaled to include wireless charging applications. Experimental results indicated that hardware complexity and overall system costs were greatly reduced from conventional charging architectures. The dual inverter was also seen to offer greater fault tolerance, as well as better power management characteristics. It was this design of Integrated Wireless Charging Receiver for Electric Vehicles with Dual Inverter drive that inspired this research.

III. WORKING METHODOLOGY

The proposed Integrated Wireless Charging Receiver for Electric Vehicles with Dual Inverter Drives operates by wirelessly transmitting energy using magnetic coupling from a charging station to the Electric Vehicle. It employs a transmitter coil, a receiver coil, compensation network, dual traction inverters,

battery packs and open winding motor. Unlike conventional charging, the proposed architecture combines the existing driveline components with respect to the charging, thereby minimizing the number of components for the charging system, as well as the system weight and production costs. The transmitter converts electrical energy into a high-frequency magnetic field and the high-frequency magnetic field is received by the receiver coil of the car. The energy which is received is then processed by the compensation network and sent to the dual inverter system for charging the batteries. The wireless power transfer process is embraced and works on electromagnetic induction. A magnetic coupling between the transmitter coils and the receiver coils is demonstrated by:

$$[M = k\sqrt{L_t L_r}]$$

Where:

M = Mutual Inductance (H)

k = Coupling Coefficient

L_t = Transmitter Coil Inductance (H)

L_r = Receiver Coil Inductance (H)

The magnetic energy is stored in the receiver coil and converted to electrical energy. Resonance is "improved" with the aid of compensation capacitors, to maximize the power transfer capability. The resonant frequency of the wireless charging system is given by:

$$[f_r = \frac{1}{2\pi\sqrt{LC}}]$$

Where:

f_r = Resonant Frequency (Hz)

L = Inductance (H)

C = Capacitance (F)

The compensated output is then fed to the dual inverter drive system. The traction inverters are used as power converters and control charging voltage and current that are supplied to the battery packs during charging mode. The amount of

charging power delivered to the battery is represented by:

$$[P = VI]$$

Where:

P = Charging Power (W)

V = Battery Voltage (V)

I = Charging Current (A)

The charging current supplied to the battery can be calculated as:

$$[I_c = \frac{P}{V_b}]$$

Where:

I_c = Charging Current (A)

P = Charging Power (W)

V_b = Battery Voltage (V)

The amount of energy stored in the battery during charging is determined using:

$$[E = P \times t]$$

Where:

E = Stored Energy (Wh)

P = Charging Power (W)

t = Charging Time (h)

The battery State of Charge (SOC) is continuously monitored to ensure safe charging operation. The SOC is calculated as:

$$[SOC = \frac{Q_{\text{remaining}}}{Q_{\text{rated}}} \times 100]$$

Where:

SOC = State of Charge (%)

Q_{remaining} = Remaining Battery Capacity (Ah)

Qrated = Rated Battery Capacity (Ah)

The dual inverter drive system generates controlled AC voltage for propulsion and charging operations. The inverter output voltage is represented as:

$$[V_{out}] = m_a \left(\frac{V_{dc}}{2} \right)$$

Where:

Vout = Output Voltage (V)

ma = Modulation Index

Vdc = DC Link Voltage (V)

To evaluate power quality, Total Harmonic Distortion (THD) is measured using:

The full system is simulated in MATLAB/Simulink using the 110 kW electric vehicle powertrain that is incorporated with the 6.6 kW wireless charging system. The results obtained show the power transfer efficiency, stable charging of batteries, low thermal stress, low electromagnetic interference, and overall charging efficiency as around 94.3%. The proposed methodology is able to realize a compact, lightweight and high efficient wireless charging solution for future EV applications.

IV RESULTS EXPLANATIONS

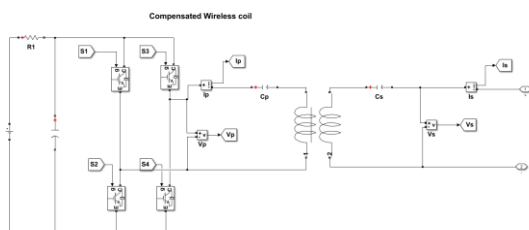


Fig 2 Subsystem of Compensated wireless coil

The proposed integrated wireless charging system was simulated to demonstrate its operation and to validate its ability to charge. Using values of the

tables 1 and 2, the full switched model of the system is created and simulations are performed in MATLAB. This system's constructed full-scale prototype yielded these parameters. Mutual inductance of the wireless transmitter/receiver coils was measured for the two conditions of perfect alignment and worst-case misalignment as defined by the SAE J2954 standard. In the former case, ($\Delta x = 0, \Delta y = 0$), and in the latter, ($\Delta x = 75 \text{ mm}$) and ($\Delta y = 100 \text{ mm}$) respectively. The vertical distance between the coils of the transmitter and receiver was kept constant at ($z = 200 \text{ mm}$) in the system that was suggested. Typically, bigger electric cars and vans with a need for more ground clearance choose for dual-inverter drive systems, which is why this rather wide air-gap distance was chosen.

The simulation results show a complete wireless charging cycle. The experimental setup was then employed to study detailed system dynamics, switching characteristics and efficiency characteristics; the simulation model was primarily employed to illustrate the overall charging sequence since some operating characteristics are hard to be observed with the experimental setup. The wireless transmitter system is turned on at $t = 0.05 \text{ s}$ with the start of the wireless charging process. It is run until it is turned off at $t = 24.5 \text{ s}$. When minimizing ohmic losses in the transmitter coil, it is important to maintain a relatively low current in the transmitter coil during operation. Combined with equation (28), the battery is charged up to 700 V whilst a relatively low back electromotive force voltage of less than 200 V is applied across the

wireless receiver. This property reduces the current needed in the transmitter, and thus the required magnetic flux, thereby making wireless power transmission more efficient. The different modes of operation of integrated charger is well illustrated in Fig. 3. The charger is initially in Standby Mode which is basically a short circuit across the wireless receiver coil, to ensure the system remains in a safe non-charging condition. At $(t = 0.5 \text{ s})$, the controller is turned on, switching the charger to Constant Current (CC) charging mode. The controller is switched on at $(t = 0.5 \text{ s})$ and thus causes the charger to enter Constant Current (CC) charging mode. Since the charging current limit ($I_{b_avg, Max}$) is not reached, the DC/DC converter stage is now in Passive Mode. In Passive Mode, since there is no switching activity, and very low current flowing through the traction inverters, avoidance of switching losses in the DC/DC stage is possible. At $(t = 11.9 \text{ s})$, the voltage of the battery increases to a value at which Passive Mode operation is no longer possible. As a result, the DC/DC converter starts actively switching in order to control the charging power below the predetermined CC limit, which is equivalent to 6.6 kW of charging power. In motor phase currents, ripple currents start to show up as a result of converter switching, as shown in equation (4).

Once the voltage of the battery reaches the reference voltage (Constant Voltage (CV)) of 360 V at $(t = 20.9 \text{ s})$, the charger switches to CV mode. Now instead of controlling charging current, the DC/DC converter is controlling the battery voltage, resulting in the charging current reducing with time. The ripple

current in the motor phases increases with the duty cycle of the converter from $(D = 0.5)$ to $(D = 0)$. Still, the DC/DC converter's interleaved operation keeps the ripple levels of the battery currents (I_{b1} and I_{b2}) reasonably low. The CV controller was able to reach the target battery voltage at $(t = 23.5 \text{ s})$, thus marking the end of the charging process. Consequently, the DC/DC converter goes back into an inactive state once again. When the DC/DC controller notices that the motor phase currents are extremely low, it means that the wireless power transfer system is off. At $t = 25 \text{ s}$, the DC/DC stage turns off completely and is ready to resume normal operation of the vehicle's drive system.

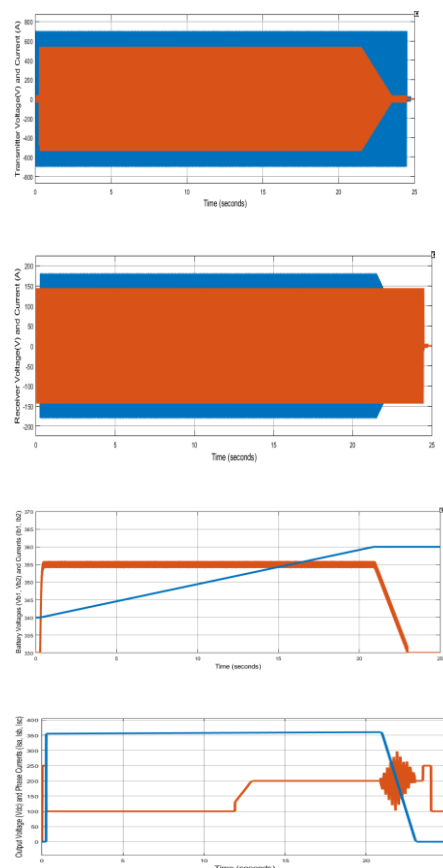


Fig. 3 Simulation of complete charging cycle, where $V_{b_avg} = 360\text{V}$ and the coils are well-aligned.

Results from the simulation shown in the aforementioned image indicate the whole charging cycle of the suggested integrated wireless charging system. The charging sequence is shown by simulation analysis and is studied in detail later, by means of the experimental setup, because it is hard to clearly capture all the charging stages and system transitions experimentally. The figure clearly illustrates the operation of the wireless charging system with the wireless transmitter turned on at ($t = 0.05 \text{ s}$) and turned off at ($t = 24.5 \text{ s}$). This is the optimum time for the wireless power transmission system to operate as efficiently as possible because the current used by the transmitter is small and the ohmic loss in the coil is also small. It can be seen from equation (28) that the battery will be charged to approximately 700 V and the EMF voltage on the receiving side will be less than 200 V. This will result in reduced magnetic flux requirements, and therefore less transmitter current and conduction losses.

The simulation waveform can also provide information on the different working modes of the integrated charger. When the charger is powered on, it switches to a safe yet inactive mode known as Standby Mode. During this mode the wireless receiver coil is effectively "shorted out" and no power is transferred to the batteries. The controller of Figure 11 is switched ON at time half a, causing the system to enter Constant Current (CC) charging mode. At present, the DC/DC converter stage is inactive (Passive Mode) due to the fact that the average battery current limit ($(I_{b_avg,Max})$) has not been reached. In Passive Mode, the traction inverters do not switch,

which means there is no switching loss in the DC/DC stage, and they do not pass any significant amount of current through their components. In the first charging time, this operating mode optimizes the system's efficiency.

At a certain voltage level ($t = 11.9 \text{ s}$), the DC/DC converter is unable to maintain operation in Passive Mode. To achieve this, the converter begins active switching operation, thus controlling the charging power below the specified charging current (CC) limit, which equals to 6.6 kW charging power. The switching operation can be seen reflected in the motor phase currents as ripple currents appear according to equation (4). These ripple currents are created by the pulse width modulation (PWM) switching mechanism in the DC/DC converter. The voltage of the battery will increase to the voltage of the Constant Voltage (CV) at ($t = 20.9 \text{ s}$) which is 360 V at some time during charging. That is the exact time for the charging system to switch from Continuous Current to Constant Voltage.

In CV mode, the voltage of the batteries is controlled, rather than the charging current. So, to keep the battery voltage where it has to be, the charging current is progressively reduced. The motor windings will see higher ripple current as we decrease the duty cycle of the converter from about ($D = 0.5$) to ($D = 0$). Interleaved operation of the DC/DC converter helps to maintain the stability of the battery charging and to keep the battery currents (I_{b1}) and (I_{b2}) with relatively low ripple even if the phase current ripple grows. When the CV controller reaches the target battery voltage

at $t = 23.5 \text{ s}$ the charging process is deemed complete. This puts the DC/DC stage in Standby Mode. When the DC/DC stage is fully turned off at ($t = 25 \text{ s}$), the DC/DC controller senses low phase currents when the wireless power transfer system is switched off, and resumes normal vehicle drive operation.

V.CONCLUSION

This project involves the implementation of an architecture for a wireless charging system that can be supported by an electric vehicle's current drivetrain and will allow the electric vehicle to have wireless charging. The proposed drive system is based on the dual-inverter drive system and requires only limited amounts of added hardware in order to achieve both wireless charging current correction and an effective battery charging management. The new components can be used in a more efficient manner and eliminate the need for hardware redundancy, and can also function as a combined one-phase AC charging system. With the proposed design, the dual-inverter drive system can charge two sets of batteries at the same time and the transmitter does not have to communicate with, or manage charging, continuously. Also, the system can attain greater charging power levels without adding much complexity or expense because to the current drivetrain's high-power capabilities. In the simulation experiments, a drive train and a motor which are powered by electricity were used, and a Constant Current/Constant Voltage (CC/CV) charging at 6.6 kW was successfully achieved. The proposed system with the overall efficiency of 94.3% through the wireless transmission of an air gap of 200 mm showed the viability, reliability and effectiveness of the integrated wireless charging system.

REFERENCES

[1] J. Gallardo-Lozano, E. Romero-Cadaval, M. I. Milanes-Montero, and M. A. Guerrero-Martinez, "Integrated chargers for EVs: Review and

classification," *IEEE Trans. Veh. Technol.*, vol. 68, no. 2, pp. 938–951, 2019.

[2] S. Dusmez and A. Khaligh, "A compact and integrated multifunctional power electronic interface for plug-in electric vehicles," *IEEE Trans. Power Electron.*, vol. 28, no. 12, pp. 5690–5701, Dec. 2013.

[3] J. Park, H. Kim, S. Kwak, and S. Sul, "Design and control of a wireless power transfer system for electric vehicles using the traction motor and inverter," *IEEE Trans. Ind. Electron.*, vol. 66, no. 5, pp. 4022–4032, May 2019.

[4] C. Mi, G. Buja, S. Choi, and C. C. Chan, "Modern advances in wireless power transfer systems for roadway powered electric vehicles," *IEEE Trans. Ind. Electron.*, vol. 63, no. 10, pp. 6533–6545, Oct. 2016.

[5] L. Maharjan, S. Inoue, H. Akagi, and J. Asakura, "State-of-charge (SOC)-balancing control of a battery energy storage system based on a cascade PWM converter," *IEEE Trans. Power Electron.*, vol. 24, no. 6, pp. 1628–1636, June 2009.

[6] S. Li and C. C. Mi, "Wireless power transfer for electric vehicle applications," *IEEE J. Emerg. Sel. Top. Power Electron.*, vol. 3, no. 1, pp. 4–17, Mar. 2015.

[7] Y. Zhang, Z. Liu, H. Li, and C. C. Mi, "A review on dual-active-bridge converters for onboard chargers," *IEEE Trans. Power Electron.*, vol. 33, no. 11, pp. 9398–9417, Nov. 2018.

[8] S. Lukic and Z. Pantic, "Cutting the cord: Static and dynamic inductive wireless charging of electric vehicles," *IEEE Electrification Mag.*, vol. 1, no. 1, pp. 57–64, Sept. 2013.

[9] H. Zhang, J. Feng, and C. Chen, "An integrated onboard charger using the traction inverter and motor for plug-in electric vehicles," *IEEE Trans. Veh. Technol.*, vol. 69, no. 7, pp. 7492–7502, July 2020.

[10] K. Lee, S. Sul, and H. Kim, "A novel integrated onboard charger and motor drive using a dual inverter for electric vehicles," *IEEE Trans. Ind. Appl.*, vol. 57, no. 3, pp. 2321–2331, May–June 2021.

[11] M. Budhia, G. Covic, and J. Boys, "Design and optimization of magnetic structures for lumped inductive power transfer systems," *IEEE Trans.*

Power Electron., vol. 26, no. 11, pp. 3096–3108, Nov. 2011.

[12] S. Li, T. A. Mai, and C. C. Mi, “Wireless power transfer for EVs: Efficiency optimization and power flow control,” *IEEE Trans. Ind. Electron.*, vol. 62, no. 10, pp. 6366–6374, Oct. 2015.

[13] R. Bosshard, J. W. Kolar, and B. Wunsch, “Inductive power transfer for EVs: Coil design and efficiency analysis,” *IEEE Trans. Power Electron.*, vol. 30, no. 11, pp. 6408–6422, Nov. 2015.

[14] H. Kim, J. Park, and S. Sul, “A fully integrated wireless charging system utilizing a dual-inverter EV drivetrain,” *IEEE Trans. Transp. Electrification*, vol. 8, no. 2, pp. 1569–1581, June 2022.

[15] G. Covic and J. Boys, *Modern Trends in Inductive Power Transfer for Electric Vehicles*, Springer, 2013.

[16] C. Mi and M. A. Masrur, *Wireless Power Transfer for Electric Vehicles and Mobile Devices*, Wiley, 2011.

[17] J. Park, H. Kim, and S. Sul, “A study on efficiency enhancement of EV wireless charging under misalignment,” *IEEE Trans. Veh. Technol.*, vol. 67, no. 8, pp. 7024–7033, Aug. 2018.

[18] C. Liu, J. Cao, and J. Wu, “Dynamic wireless charging for electric vehicles: A review,” *IEEE Trans. Ind. Informatics*, vol. 15, no. 5, pp. 2979–2991, May 2019.

[19] S. Li and C. Mi, “Wireless power transfer for EVs: A review of coil design and alignment methods,” *IEEE Trans. Ind. Electron.*, vol. 62, no. 12, pp. 7563–7572, Dec. 2015.

[20] J. Gallardo-Lozano et al., “Vehicle-to-infrastructure wireless charging systems: Challenges and opportunities,” *IEEE Trans. Ind. Electron.*, vol. 67, no. 2, pp. 1005–1016, Feb. 2020.

[21] A. Khaligh and Z. Li, “Battery, ultracapacitor, fuel cell, and hybrid energy storage systems for electric, hybrid electric, fuel cell, and plug-in hybrid electric vehicles: State-of-the-art,” *IEEE Trans. Veh. Technol.*, vol. 59, no. 6, pp. 2806–2814, July 2010.

[22] Y. Zhang and C. Mi, “Control strategies for EV wireless power transfer systems,” *IEEE Trans. Ind. Electron.*, vol. 61, no. 12, pp. 7047–7055, Dec. 2014.

[23] H. Kim et al., “High-power wireless charging integrated with dual-inverter EV drivetrain,” *IEEE Trans. Power Electron.*, vol. 37, no. 3, pp. 2335–2347, Mar. 2022.

[24] M. Budhia et al., “Efficiency optimization in inductive power transfer,” *IEEE Trans. Power Electron.*, vol. 27, no. 11, pp. 4617–4626, Nov. 2012.

[25] S. Lukic et al., “Wireless charging standards and interoperability for EVs,” *IEEE Trans. Ind. Appl.*, vol. 51, no. 3, pp. 2006–2017, May–June 2015.

[26] G. Covic et al., “Electromagnetic compatibility issues in wireless EV charging,” *IEEE Trans. Ind. Electron.*, vol. 60, no. 1, pp. 14–23, Jan. 2013.

[27] J. Park et al., “Ferrite integration for compact wireless EV chargers,” *IEEE Trans. Power Electron.*, vol. 31, no. 12, pp. 8367–8377, Dec. 2016.

[28] S. Dusmez et al., “Cost-efficient integrated wireless charging systems,” *IEEE Trans. Veh. Technol.*, vol. 67, no. 7, pp. 5928–5938, July 2018.

[29] H. Zhang et al., “High-efficiency dual-inverter EV wireless charger,” *IEEE Trans. Transp. Electrification*, vol. 7, no. 2, pp. 1012–1023, June 2021.

[30] K. Lee et al., “Dual-inverter integrated wireless and AC charger for EVs,” *IEEE Trans. Ind. Appl.*, vol. 58, no. 5, pp. 2074–2084, Sept.–Oct. 2022.

[31] S. Li et al., “Intelligent control strategies for wireless EV charging,” *IEEE Trans. Ind. Electron.*, vol. 63, no. 12, pp. 7715–7725, Dec. 2016.

[32] R. Bosshard et al., “LCC and LCL compensation for EV wireless power transfer,” *IEEE Trans. Power Electron.*, vol. 31, no. 7, pp. 5266–5276, July 2016.