Department of Electrical and Electronics Engineering
NATIONAL INSTITUTE OF TECHNOLOGY KARNATAKA, SURATHKAL

Ref. No.: NITK/E&E/SERB-SEV/2021-22/A8 dated 07/07/2021

Advertisement for Summer Internship

Applications are invited for the position of Summer Internship in a research and development project **(SERB-CRG**) with the following details:

Title of the project:

"Smart Electric Vehicle Supply Equipment with Improved Reconfigurability, Economic, Availability, and Performance (REAP)"

Principal Investigator:

Dr. B. Dastagiri Reddy,
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Name of the position: Summer Internship

No. of Positions/Vacancies: One

Qualifications:

Essential Qualifications: - Candidate studying in Prefinal year or final year **B.E./B.Tech** in Electrical/Mechanical with a minimum of 65% aggregate score (6.5/10 CGPA).

Desired Skills: -

- ➢ MATLAB/Simulink and Ansys.
- ➢ Experience in Power electronics experimental research.

Age Limit: 25 years (Preferable)

Salary: Rs. 5,000/month

Duration: 2 Months

How to apply: Interested candidates must apply with the following documents (1) Cover letter (2) Bio-data with a passport-sized photograph, (3) Scanned copies of educational certificates and mark sheets in the google form https://forms.gle/8T4QJtRiL1upQpJj7
Only shortlisted candidates will be intimated by email and called for an **Online interview**. The position is available immediately. The appointment will be on a purely temporary basis co-terminus with the project.

About the project:
Total duration: 3.5 YEARS (2021-2024)-Funding Agency: Science & Engineering Research Board (SERB)

Project summary:

Most of the existing EV charging stations are equipped with certain number of commercially available chargers and which is not economic. Each charger consists of a rectifier and a DC-DC converter. In order to meet the grid code, based on the rating of the charger, most of the chargers have 1) rectifier with power factor correction or 2) active IGBT based rectifier as the rectification stage. The cost of 400 kW IGBT based active rectifier is around 28-32 kUSD, whereas the 12p TB Thyristor or diode bridge rectifier is about 7-10 kUSD. However, the 6-pulse or 12-pulse thyristor or diode bridge rectifiers are unable to meet the grid code and are not bidirectional. In order to meet the grid, a conventional 12p TB is equipped with active or passive filters and hence the system becomes bulky and as expensive as 6p IGBT rectifier. To reduce the investment of a charging station, it is recommended to have a common rectification stage for all the chargers and provide different DC-DC converters as per the charging requirement of EVs. This recommendation can reduce the cost of charging station to an extent. However, the problems associated with IGBT based rectification stage persist. Hence, This project is proposed to address the above mentioned issues.

A novel design of 12-pulse Thyristor Bridge (12p TB) is proposed for the rectification stage. The proposed 12-pulse thyristor bridge meets the grid code IEEE519 without using special controllers, active/passive filters at high loading conditions. The proposed design also enables the bidirectional power flow operation of the 12p TB, i.e., active power can be fed back to the grid. Clearly, a cost saving of about 30-40% can be achieved in the rectification stage.

In addition, a novel design of IGBT based 3-leg bridge is proposed to utilize it as DC-DC converter (buck/boost), DC-AC converter and AC-DC converter to meet the charging requirements of different EVs. It is also proposed to utilize these IGBT converters for reactive power compensation when the charging station is lightly loaded.

In order to make the charging station smart enough to take decisions on reconfiguration of IGBT converters and bidirectional operation of 12p TB, an intelligent energy management system is inevitable.

As the utilization rate of converters are quite high in the proposed smart charging station, significant amount of heat can be generated. Improper cooling of the charging station enclosures will result in reduction in component life, local damages or even failure of the system. Hence, thermal analysis of the charging station will be carried out using Computational Fluid Dynamics (CFD) techniques to identify the losses and hot spots. Based on the analysis suitable thermal management system will be designed.