Proposal for announcing seat under the Institute Internship Program

(separate form to be filled for seat under Institute funding and project funding)

1. Name of faculty member proposing: *Dr. Rajendra Mitharwal*
2. Department/Centre: *Department of Electronics and Communication Engineering*
3. Topic on which work is proposed: *Computational Electromagnetics*

4. Preferred period of internship (after May 20th): *Between 21 May 2024 to 21 July 2024*

5. Qualification of student (branch/semester of study): *Electronics, Computer Science or Electrical*

6. Brief description of work (300-500 words):

Source Reconstruction Methods (SRMs) have effectively enhanced near-field measuring approaches in antennas, as well as in Electromagnetic Interference (EMI). Significantly, the challenges related to EMI become more prominent as new electronic devices with high data rate requirements push operating frequency limits to the higher side of the spectrum. A single electronic device can have an antenna, power supply, sensors, and memory chips. Identifying the components responsible for the EMI in the design phase becomes challenging. SRMs can be the panacea to such scenarios where the numerical estimation can be done during the design phase as the practitioner need not change the code developed once for any change in the electronic design of the device. In other words, SRMs are geometrically independent; further design iteration can reuse the previously constructed equivalent source.

A Device Under Test (DUT) causing EMI can be decided based on prescribed limits on the radiated electromagnetic field values by the radiated emission standards. The measurement setup for such standards requires that the DUT radiate on a spherical surface of 3 or 10m. The maximum value of the radiated field on this surface should be less than the prescribed field value of the selected standard to certify the DUT as compliant. Now, depending on the operating frequency and the size of the DUT, the distance of 3m or 10m can lie in the near field or far field region. The numerical estimation of the radiated emissions can be achieved by employing SRMs in the near field region of the DUT and then applying the near field to far field transformations (near field to near field if the 3m distance is in the near field of the DUT) to obtain field values at 3m distance. The equivalent source can be constructed using boundary elements, dipole moments, or wave expansions. In the case of boundary elements methods, the radiating elements are the electric or surface currents on an equivalent surface. Similarly, dipole moment-based methods deploy the electric, magnetic, or combination of both dipoles on the surface.

Source Reconstruction Methods are continuously enhanced for estimating the radiated emissions from electronic devices. In this work, inspired by the state-of-the-art methods using eigenmode current approaches for estimating electromagnetic interference, the intern will work on a two-step source reconstruction method based on different threshold criteria. The threshold is based on the

coefficients of the equivalent set of dipoles placed on a closed surface enclosing the device computed in the first step. The non-redundant dipoles used in the second step compress the overall system matrix and satisfactorily reconstruct the fields at any point external to the closed surface with acceptable accuracy. The proposition will be tested on numerical examples with varied operating frequencies and geometrical features. The comparison of the proposed method with the conventional method for noisy measurement data is also planned.

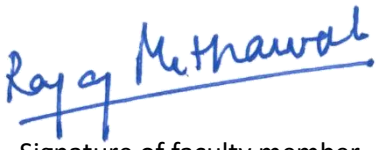
7. Expected learning of student (upto 100 words):
   The student will learn

   a. *the coding skills in Python or C++.*
   b. *the core application of scientific computing in the area of electronics.*
   c. *the state-of-art techniques in the area of source reconstruction in Electromagnetic Interference.*
   d. *solving the Maxwell's equations numerically.*
   e. *the limits and convergence issues of the inverse problem arising in Engineering.*

8. Nature of work: (Experimental/simulation/mathematical modelling/data collection-analysis etc.): upto 50 words

   Mathematical Modelling and development of Scientific Computing Applications

9. If the seat is under project sponsored category: **No**
   a) If yes, number of seats announced:
   b) Name and ID no. of project from which stipend is chargeable



Signature of faculty member

Department of ECE

Note:

a) Proposing faculty member needs to be available at the Institute during the period internship is offered
b) No extra space or funding than the stipend will be provided by the institute for this purpose