



Module PMRF-ISSS032/2023

Solving differential equations with computers: from Taylor series to neural networks

Name of the PMRF student

Priyabrat Dash

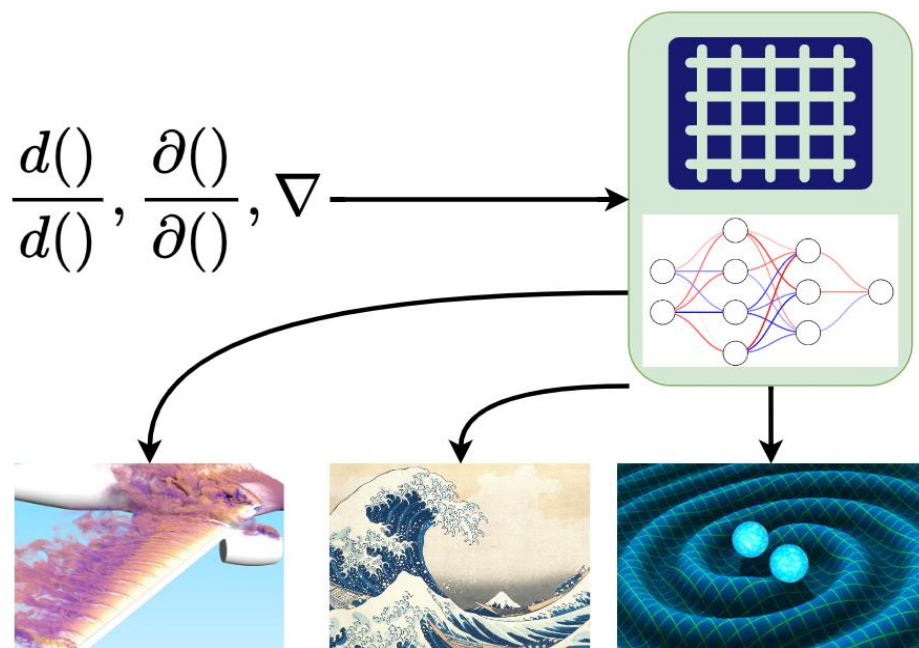
Required background of the students taught

Mechanical, Aerospace, Chemical and Civil Engineering, Basic Sciences

Pre-requisites: Undergraduate level calculus and linear algebra, programming in any language

Online session coordinator

Will be chosen from the list of registrants



Details of the content of the module

Module 1: Introduction

- Scientific computing and conservation laws; basic Python programming; Python libraries: NumPy and matplotlib

Module 2: Approximation of differential operators and ordinary differential equations (ODEs)

- Taylor series, finite differences (FD); solution of ODEs using FD schemes; system of equations and stiffness; accuracy, stability and errors

Module 3: Approximate solutions of partial differential equations (PDEs)

- Classification and examples of PDEs; FD formulation of elliptic, parabolic and hyperbolic PDEs; von-Neumann stability analysis

Module 4: Solutions using machine learning (ML)

- Introduction to ML and neural nets; classification and regression using PyTorch; physics-informed neural networks: forward and inverse problems, neural differential equations and operator learning

(EACH CONCEPTUAL BLOCK WILL BE ACCOMPANIED WITH CODE DEMONSTRATION)

Schedule of the module

- Live lectures on Wednesdays (6:30 PM to 8:30 PM)
- In unforeseen situations, recorded lectures will be uploaded by 6:30 PM.
- Additional sessions can be scheduled on weekends for further discussions
- Starts: 6th September 2023
- Ends: 29th November 2023

Meeting link : Will be shared later

Contact email ID: issc.forum@gmail.com

Registration link:

<https://forms.gle/3cCB317iiaxLnbm58>