



Surrogates and Approximations in Engineering Design

Aerospace Engineering

Instructor Name: Palaniappan Ramu

Institute: IIT Madras

Department: Engineering Design

Course Intro: : In the context of engineering design, often the functional objective and the design constraints are approximated by connecting the design variables and the responses of interest at few points on the design space. Since these are approximation of the original functions, they are called surrogates and are widely used in design studies. This course will focus on introducing such surrogates “ on how to build, evaluate and use them in design. Surrogates discussed will include polynomial regression, kriging and radial basis function while Design of Experiments discussions will include latin hypercube sampling and hammersley sequence.

Pre Requisites: : None

Core/Elective: : Elective

UG/PG: : PG

Industry Support : Not sure Fiat Chrysler Automotive, Cyient, Mahindra

Reference : Forrester, A., & Keane, A. (2008). Engineering design via surrogate modelling: a practical guide. John Wiley & Sons.

About Instructor: Prof. Palaniappan Ramu’s research interest revolves around optimization and treating uncertainties in product and process design to obtain reliable, robust and quality designs. Most of his work is focused on reduction of computer or physical experiments, building better metamodels, intelligently explore design space and enable better predictions and optimal designs under uncertainties.



COURSE PLAN

SL.NO	Week	Module Name
1	1	Introduction, physical versus computational experiments, introduction to engineering optimization, need for surrogates in optimization
2	2	Sampling plans, Latin squares, latin hypercubes sampling, stratification, Orthogonal arrays, hammersley sequences
3	3	Surrogates: Polynomial Regression, Radial basis function, Kriging
4	4	Using surrogates in design space exploration and exploitation, infill criteria, adaptive sampling