Phase field modelling for microstructural evolution

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Overview

Microstructures determine the engineering properties of materials. Microstructure develops during the processing and hence plays the key role of bridging processing to properties. Further, in service, microstructures continue to evolve, resulting in continuous changes of properties. Hence, understanding microstructural evolution is an important problem of industrial interest. In addition, the problem of (physics based) modelling of microstructural evolution, is also important from both the academic and applications points of view. In the past two decades, phase field models have emerged as one of the strong contenders for the modelling of microstructural evolution.

Phase field models are physics based models (unlike their level set counterparts). Phase field models can be shown to be thermodynamically consistent. They incorporate many important interface related physical phenomena (such as the Gibbs-Thomson effect, for example). Unlike the sharp interface models, phase field models do not require an explicit tracking of interfaces and hence are ideal models for computer based implementations in scenarios where topological singularities such as merging, disappearance and appearance of interfaces occur.

The primary objectives of the course are as follows: (i) Motivating the physics and mathematics of phase field models using spinodal decomposition and order-disorder transformations as model problems; (ii) Familiarising the participants with mathematical aspects of the phase field models such as group theory, variational calculus, linear stability analysis, asymptotic analysis, etc; (iii) Providing hands-on tutorial sessions for students to build (finite difference and spectral technique based) numerical implementations of phase field models; and, (iv) Building phase field models for precipitate growth kinetics in systems with and without coherent interfaces, grain growth, and grain boundary grooving.

Modules	**A: The mathematics, materials science and numerical aspects of Cahn-Hilliard equation: March 23 - March 24** **B: Allen-Cahn equation, applications and advanced topics: March 26 - March 28** **Number of participants for the course will be limited to thirty.**
You Should Attend If...	▪ you are a scientist interested in modelling microstructural evolution with background in materials science, metallurgy, ceramics, polymer science and/or physics. ▪ you are a mathematician or a programmer interested in applications relevant to materials science and engineering. ▪ you are a student or faculty from academic institution interested in learning phase field method to model microstructural evolution.
Fees	The participation fees for taking the course is as follows: **Participants from abroad : US $500** **Industry/ Research Organizations: INR: 30000/-** **Academic Institutions/ Faculty/ NGO: INR: 8000/-** **Students & Research Scholars: INR: 3000/-** The above fee include all instructional materials, computer use for tutorials and assignments, laboratory equipment usage charges, and internet usage. The participants will be provided with accommodation on payment basis.

The Faculty

Prof. Peter W Voorhees is Frank C. Engelhart Professor of Materials Science and Engineering and (by courtesy) Professor of Engineering Sciences and Applied Mathematics. His research group is focused on the kinetics of phase transformations using experiment, simulation, and theory.

Prof. M P Gururajan is an Associate Professor of Indian Institute of Technology Bombay at Mumbai. His research interests include atomistic and continuum modelling of phase transformation and deformation induced microstructural evolution

Course Co-ordinator

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http://www.gian.iitkgp.ac.in/

GIAN Short Term Course on

Phase field modelling for microstructural evolution

- **23 – 28 March 2018**

Registration Form

Name(in block letters): _____
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Qualification:

Designation: _____

Organization:_____

Mailing Address:_____
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Mobile:_____
Fax:_____

Email:_____

Payment: Rs:_____

DD No.:_____Dt: _____

(DD in favour of "Registrar, IIT Bombay – CEP a/c")

Or NEFT/ RTGS
(Please furnish the foll. details if NEFT/RTGS)
Name of A/c Holder
UTR NO./Transaction ID
Name of Bank & Branch
Date of Payment
Amount

IIT Guest House/ Hostel accommodation required: YES / NO

Signature of Applicant:_____

Date:

Venue for Classes

Classes will be held in Computational Lab of Department of Metallurgical Engineering and Materials Science, IIT Bombay.

Date & Time of Registration:

23rd March 2018, 8.00 AM at Metallurgical Engineering and Materials Science Department, IIT Bombay.

- **COURSE FEE**

Participants from abroad: US $500/-

Industry/ Research Organizations: INR: 30000/-

Academic Institutions/ Faculty/ NGO: INR: 8000/-

Students & Research Scholars: INR: 3000/-

The above fees include all instructional materials, computer use for tutorials and assignments, laboratory usage charges, and internet access. Subject to availability, the participants will be provided with accommodation on payment basis.

The fees may be paid by demand draft drawn in favour of "**The Registrar, IIT Bombay - CEP Account".**

Or through NEFT/RTGS:

Name of beneficiary: Registrar, IIT Bombay

Account name: IIT Main Account

Name of Bank: State Bank of India, IIT Powai

Beneficiary A/C No: 00000010725729128

Bank MICR Code: 400002034

IFSC Code: SBIN0001109

SWIFT Code: SBININBB519