INVERSE HEAT TRANSFER PROBLEMS

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Resumo/Abstract:
Inverse heat transfer problems deal with the estimation of unknown quantities appearing in the mathematical formulation of physical processes in thermal sciences, by using measurements of temperature, heat flux, radiation intensities, etc. Originally, inverse heat transfer problems have been associated to the estimation of an unknown boundary heat flux, by using temperature measurements taken below the boundary surface of a heat conducting medium. On the other hand, recent technological advancements often require the use of involved experiments and indirect measurements, within the research paradigm of inverse problems. Nowadays, inverse analyses are encountered in single and multi-mode heat transfer problems, dealing with multi-scale phenomena. Applications range from the estimation of constant heat transfer parameters to the mapping of spatially and timely varying functions, such as heat sources, fluxes and thermophysical properties. In this presentation, classical regularization techniques, as well as techniques within the Bayesian framework, are briefly reviewed and then applied to inverse problems of nowadays practical interest in heat transfer, such as, in the characterization of heterogeneous media, detection of contact failures in composites, as well as the identification of the temperature fields in oil pipelines and in electric cables.