SAID BUSINESS SCHOOL, University of Oxford

SEMINAR SERIES / Trinity 2013

For further information please contact the Cabdyn Administrator:

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Seminar webpage: www.cabdyn.ox.ac.uk/complexity_seminars.asp

Sandwiches and drinks will be provided

Please note: although the seminar programme detailed was correct at time of printing, seminar arrangements are subject to change – for the latest information, please check the seminar webpage.

'Getting a grip on the grid: physics in electrical power systems'

Michael Chertkov
Los Alamos National Laboratory

Tuesday 23rd April 2013, 12.30 -14.00
Andrew Cormack Seminar Room, Saïd Business School

ABSTRACT:

Today's electric power grids, the largest engineered systems ever built, already demonstrate complex nonlinear dynamics where, e.g., localized collective effects of thousands of small consumer appliances may produce serious malfunctions of sections of the grid. These collective dynamics are not well understood and are expected to become more complex in tomorrow's grids as consumer appliances become more intelligent and autonomous. Tomorrow will have to integrate the intermittent power from wind and solar farms whose fluctuating outputs create far more complex perturbations. Guarding against the worst of those perturbations will require taking protective measures based on ideas from probability and statistical physics.

In this talk aimed at applied mathematicians, physicists and network scientists we briefly review the history of electrical grids and then introduce a few of the physical, optimization and control principles and phenomena in today's grids and those that are expected to play a major role in tomorrow grids.

We illustrate the new science of the grid on two example: (a) discussing an efficient and highly scalable Chance Constrained Optimal Power Flow algorithm providing risk-aware control of the transmission system under uncertainty associated with fluctuating renewable (wind farms); and (b) discussing ODE and PDE modeling of the power distribution system, in particular explaining effects of many inductive motors and distributed photo-voltaic generators on the grid stability.

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