

The role of phase transitions in network control and design

Venkat Anantharam

► **To cite this version:**

Venkat Anantharam. The role of phase transitions in network control and design. WiOpt'03: Modeling and Optimization in Mobile, Ad Hoc and Wireless Networks, Mar 2003, Sophia Antipolis, France. 1 page. <inria-00466143>

HAL Id: inria-00466143

<https://hal.inria.fr/inria-00466143>

Submitted on 22 Mar 2010

HAL is a multi-disciplinary open access archive for the deposit and dissemination of scientific research documents, whether they are published or not. The documents may come from teaching and research institutions in France or abroad, or from public or private research centers.

L'archive ouverte pluridisciplinaire **HAL**, est destinée au dépôt et à la diffusion de documents scientifiques de niveau recherche, publiés ou non, émanant des établissements d'enseignement et de recherche français ou étrangers, des laboratoires publics ou privés.

The role of phase transitions in network control and design

Venkat Anantharam
EECS Department
University of California
Berkeley, CA 94720

A common characteristic of many ad hoc networks being currently developed is their large scale. This is particularly true of proposals for the so called “smart dust” which aim to create networks by sprinkling an extremely large number of very simple nodes to create ad hoc networks for tasks such as surveillance, temperature monitoring, earthquake detection, etc. Large scale stochastic systems exhibit complicated macroscopic behaviour on an aggregate level, among the most interesting of which is the existence of multiple phases : identical local dynamic can give rise to widely different global dynamics. Some instances of this phenomenon in communication networks will be discussed.

Network design problems are considerably complicated and enriched by the phenomenon of multiple phases. For instance, certain phases may be more desirable than others, so one of the goals of design should be to ensure that the dynamics of the more favourable phase dominates the global behaviour of the network. What is more, control of the network can exploit the existence of multiple phases : the control effort can be expended cleverly so as to create the appropriate pattern of global dynamics in the network to achieve the desired goals with least effort. Examples of such design issues in the networking context that involve multiple phases will be discussed.

Venkat Anantharam is on the faculty of the EECS department at UC Berkeley. He is a recipient of the Philips India Medal and the President of India Gold Medal from IIT Madras, an NSF Presidential Young Investigator award from the U.S. National Science Foundation, and an IBM Faculty Development award. He is a co-recipient of the 1998 Prize Paper award of the IEEE Information Theory Society and a co-recipient of the 2000 Stephen O. Rice Prize Paper award of the IEEE Communications Theory Society. He is a past associate editor for the IEEE Transactions on Information Theory and for the Annals of Applied Probability. His research interests include problems arising in communications, communication networks, game theory, information theory, probability theory and its applications, queueing networks, and stochastic control. He is a Fellow of the IEEE.