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# Exponential stabilisability of finite-dimensional linear systems with limited data rates $\hat{a} \sim \dagger$

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## Abstract

A critical notion in the field of communication-limited control is the smallest data rate above which there exists a stabilising coding and control law for a given plant. This quantity measures the lowest rate at which information can circulate in a stable feedback loop and provides a practical guideline for the allocation of communication resources. In this paper, the exponential stabilisability of finite-dimensional LTI plants with limited feedback data rates is investigated. By placing a probability density on the initial state and casting the objective in terms of state moments, the problem is shown to be similar to one in asymptotic quantisation. Quantisation theory is then applied to obtain the infimum stabilising data rate over all causal coding and control laws, under mild requirements on the initial state density.

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## Keywords

Stabilisability; Exponentially stable; Communication channels; Quantisation

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**Girish N. Nair** was born in Petaling Jaya, Malaysia. He obtained a B.E. (Elec.) in 1994, B.Sc. (mathematics) in 1995 and Ph.D. (electrical engineering) in 2000, all from the University of Melbourne. Since Sep. 1999 he has been a member of faculty at the Department of Electrical and Electronic Engineering at the university, initially as lecturer and from Jan. 2002 as senior lecturer. His current research interests lie in the intersection of communications, information theory and control. He is the recipient of several prizes, including the Best Theory Paper award at the UKACC Int. Conf. Control, Cambridge, 2000 and the L. R. East Medal in electrical engineering, 1994.



**Rob Evans** was born in Melbourne, Australia, in 1947. After completing a BE degree in Electrical Engineering at the University of Melbourne in 1969, he spent 5 years as an engineering officer with the Royal Australian Air Force, working in the area of radar systems. He then completed a PhD in 1975 at the University of Newcastle, Australia, followed by postdoctoral studies at the Laboratory for Information and Decision Systems, MIT, USA, and the Control and Management Department, Cambridge University, UK.

In 1977 he took up an academic position at the University of Newcastle, where he was Head of the Department of Electrical and Computer Engineering from 1986–1991. In

1992 he moved to the University of Melbourne, where he was Head of the Department of Electrical and Electronic Engineering until 1996.

His research has ranged across many areas, including control theory, radar systems, signal processing, and computer systems. He is a Fellow of the Australian Academy of Science.

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