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Mathematics of finite-dimensional control systems. Theory and design, by David L. Russell, Lecture Notes in Pure and Applied Mathematics, Vol. 43, Marcel Dekker, New York and Basel, 1979, viii + 553 pp., $45.00.

Control theory was brought into existence during the second half of the eighteenth century by the development of complex machinery such as the steam engine. Since that time until about 1900 it was primarily concerned with elimination of undesirable traits (chiefly instability) by means of feedback devices, the Watt governor being a notable example; design was mainly the result of intuition and empirical insights. The beginning of the theory can be traced to J. C. Maxwell's celebrated paper on governors [1]. Progress was slow during the nineteenth century but became faster after 1900 due to the development of power transmission, communications and complex processing plants and some mathematical techniques (such as the Routh-Hurwitz stability criteria) began to be systematically used. Growth was enormous during and after the second World War and many other mathematical tools like Laplace transforms and probability theory found applications. In the late fifties and early sixties, starting with the work of Bellman, Glicksberg and Gross [2], Bellman [3], Pontryagin, Boltyanskiĭ, Gamkrelidze and Mischenko [4], Kalman [5], Kalman and Bucy [6] and others, control theory began to be accepted as a respectable mathematical discipline. It also started to absorb relatively sophisticated "modern" mathematics into its language (for instance measure theory, elementary functional analysis, abstract algebra and Liapunov stability theory) and brought to the forefront the idea of *quality of control*: if the control engineer was content in the past, say, with rendering stable the operation of a machine by means of a feedback device his modern counterpart would try to achieve the same effect in a suitably optimal way (for instance, minimizing the stabilization time, the cost of the control device, the strain on the machinery, etc.). Finally, concepts like controllability, observability and stabilization by feedback, until then living in a latent state in the literature were given precise formulations.

Although many of the initial contributions to the mathematical theory of control were firmly rooted in reality (for instance, the influence of [3] and [6] in modern technology was and is enormous) control theory tended to develop along two parallel lines since the early sixties. The first is practiced by