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ADAPTIVE CONTROL OF MULTIVARIABLE SYSTEMS(U) YALE UNIV
NEW HAVEN CT CENTER FOR SYSTEMS SCIENCE A S MORSE
01 OCT 85 AFOSR-TR-85-1113 AFOSR-84-0242

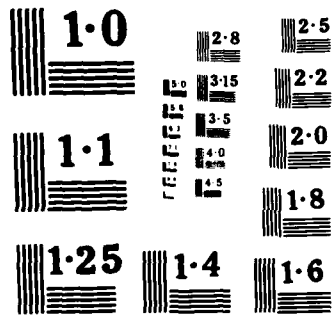
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CENTER FOR SYSTEMS SCIENCE

ADAPTIVE CONTROL OF MULTIVARIABLE SYSTEMS
AFOSR-TR-84-0242
INTERIM SCIENTIFIC REPORT
for the period
July 15, 1984 - July 14, 1985

Submitted to the
UNITED STATES AIR FORCE
OFFICE OF SCIENTIFIC RESEARCH
under
AFOSR GRANT NO. 84-0242

A. Stephen Morse, Principal Investigator

October 1, 1985

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YALE UNIVERSITY
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19. ABSTRACT (Continue on reverse if necessary and identify by block number)

During this period the Principal Investigator wrote six technical papers. Titles are: "New directions in parameter adaptive control", "Adaptive stabilization of linear systems with unknown high frequency", "A smooth algorithm for adaptive stabilization of a discrete linear system with an unknown high frequency gain", "A 4(n+1)-dimensional model reference adaptive control for the stabilization of any strictly proper minimum phase linear system with relative degree not exceeding two and dimension not exceeding n", "Adaptive stabilization of a discrete linear system with an unknown high frequency gain", and "A three dimensional universal controller for the adaptive stabilization of any strictly proper minimum-phase system with relative degree not exceeding two".

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AIR FORCE OFFICE OF SCIENTIFIC RESEARCH (AFOSR)

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10/1/85

I. INTRODUCTION

This is an interim scientific report for AFOSR Grant No. 84-0242 covering the period July 15, 1984 to July 14, 1985. The work described below has been undertaken in accordance with our January 1, 1984 starting date research proposal.

II. COMPLETED WORK

A. Research Reports and Papers

- [1] A. S. Morse, "New Directions in Parameter Adaptive Control," Proc. 1984 IEEE Conf. on Decision and Control, Dec. 1984.
- [2] D. R. Mudgett and A. S. Morse, "Adaptive Stabilization of Linear Systems with Unknown High-Frequency Gains," IEEE Trans. Auto. Control, June 1985, also Proc. 1984 IEEE Conf. on Decision and Control, Dec. 1984.
- [3] D. R. Mudgett and A. S. Morse, "A Smooth Algorithm for Adaptive Stabilization of a Discrete Linear System with an Unknown High Frequency Gain," Proc. 1985 ACC, June 1985.



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- [4] A. S. Morse, "A $4(n+1)$ -Dimensional Model Reference Adaptive Control for the Stabilization of Any Strictly Proper Minimum Phase Linear System with Relative Degree Not Exceeding Two and Dimension Not Exceeding n ," Proc. 7th Int. Symp. on the Math. Theory of Networks and Systems, Stockholm, June 1985.
- [5] D. R. Mudgett and A. S. Morse, "Adaptive Stabilization of a Discrete Linear System with an Unknown High-Frequency Gain," IEEE Trans. Auto. Control, Aug. 1985.
- [6] A. S. Morse, "A Three-Dimensional Universal Controller for the Adaptive Stabilization of Any Strictly Proper Minimum-Phase System with Relative Degree Not Exceeding Two," IEEE Trans. Auto. Control, December 1985.

B. Presentations

- [1] A. S. Morse, "New Directions in Parameter Adaptive Control," IEEE Conf. on Decision and Control, Dec. 1984.
- [2] D. R. Mudgett and A. S. Morse, "Adaptive Stabilization of Linear Systems with Unknown High-Frequency Gains," IEEE Conf. on Decision and Control, Dec. 1984.

- [3] D. R. Mudgett and A. S. Morse, "A Smooth Algorithm for Adaptive Stabilization of a Discrete Linear System with an Unknown High Frequency Gain," 1985 ACC, June 1985.
- [4] A. S. Morse, "A $4(n+1)$ -Dimensional Model Reference Adaptive Control for the Stabilization of Any Strictly Proper Minimum Phase Linear System with Relative Degree Not Exceeding Two and Dimension Not Exceeding n ," 7th Int. Symp. on the Math. Theory of Networks and Systems, Stockholm, June 1985.

C. Other Activities

During the reporting period, the principal investigator attended the 1984 IEEE Conference on Decision and Control in Las Vegas, Nevada and the MTNS-85 Conference in Stockholm, Sweden. D. Mudgett, a graduate student supported by the grant, attended the IEEE/CDC Conference in Las Vegas and the ACC Conference in Boston.

III. WORK IN PROGRESS

Research continues in accordance with our July 16, 1985 starting date proposal. A major effort is being made to answer question 5 - Is error augmentation necessary for adaptive stabilization - and question 8 - What must be done to adaptively stabilize nonminimum phase systems?

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