

# Nonlinear Model Reference Adaptive Control (NMRAC) for Multiple-Input, Multiple-Output Systems

Dalim Wahby  
*Université Côte d'Azur*  
*I3S/CNRS*  
Sophia Antipolis, France  
wahby@i3s.unice.fr

Alvaro Detailleur  
*IDSC*  
*ETH Zürich*  
Zürich, Switzerland  
adetailleur@student.ethz.ch

Guillaume Ducard  
*Université Côte d'Azur*  
*I3S/CNRS*  
Sophia Antipolis, France  
ducard@i3s.unice.fr

*Abstract*—...

*Index Terms*—Neural Networks, Gradient Descent, Control, Lyapunov Method

## I. INTRODUCTION

[1]

## II. LITERATURE REVIEW AND CONTRIBUTIONS

## III. DEFINITIONS AND NOMENCLATURE

**Definition 1** (System). A system ...

**Definition 2** (Stability). A system ...

**Definition 3** (Lyapunov Function). A system ...

**Definition 4** (Converse Lyapunov Theorem). A system ...

## IV. METHODOLOGY

## V. NUMERICAL RESULTS

## VI. IMPLEMENTATION ON A SYSTEM

## VII. CONCLUSION

## REFERENCES

- [1] D. Wahby and G. Ducard, "Enhanced PID Neural Network Control (EPIDNNC) - A Model Reference Approach," *2024 9th International Conference on Robotics and Automation Engineering*,