

Preface

This monograph serves as lecture notes for the course “Non-identifier Based Adaptive Control in Mechatronics” which I give annually in the summer term at the Technical University of Munich (TUM), Germany.

It is based on my dissertation [118] and has been rearranged, rewritten, and extended by generalizations of the considered system classes and by recent research results on anti-windup [120, 123], current funnel control of electrical machines [123], disturbance observers for elastic industrial servo-systems and wind turbine systems [119, 124], position funnel control with internal model of industrial servo-systems [126], position funnel control of robotic systems [117, 125], and speed funnel control of wind turbine systems [121, 124].

Part I motivates and introduces the considered non-identifier motion control problems, highlights the key historical developments in control systems and mechatronics, and summarizes the contributions of this monograph.

Part II presents the theory of non-identifier based adaptive control in a didactic and self-contained manner: As simple results are usually the basis for more difficult results, all extensions and generalizations of preceding results are shown in the same style, by reusing very similar logical steps/ideas and with identical notation such that the reader can follow as easily as possible and without the need of looking up several additional references.

This didactic approach leads to repetitions in the presentation and argumentation. Most of the proofs are given in full length and detail. In particular for engineering students without background in systems and control theory, various problems and their solutions are collected in Part V. The thorough discussions of the solutions shall ease insight and deepen understanding of the mathematical notions used in this book.

Part III discusses possible applications of non-identifier-based adaptive control in mechatronics and includes comprehensive modeling sections which might be a valuable source for students, engineers, and researchers working in systems and control theory and related fields.

Part IV concludes the book by a summary of the key outcomes and by an outlook describing open problems and possible future research directions.

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