# *The Impact of Control Technology, 2nd Edition*

## Introduction

Control is everywhere. Aircraft and spacecraft, process plants and factories, homes and buildings, automobiles and trains, cellular telephones and networks . . . these and other complex systems are testament to the ubiquity of control technology. Some artifacts of modern times would simply not be possible without control. And for many others, substantial, even revolutionary, advances in their performance, safety, reliability, and affordability have been achieved as a result of the ingenuity and effort of control engineers and scientists.

The realized impact of control technology is matched—indeed, overmatched—by its anticipated future impact. Decades of successful applications have hardly exhausted the potential or vitality of the field. The number and size of control conferences and journals continue to grow, new societal imperatives highlight the importance of control, and investments in control technology and technologists are taking place in old and new industrial sectors. Control is not only considered instrumental for evolutionary improvements in today's products, solutions, and systems; it is also considered a fundamental enabling technology for realizing future visions and ambitions in emerging areas such as biomedicine, renewable energy, and critical infrastructures.

The increasing complexity of technological systems demands inter- and cross-disciplinary research and development. Collaborations between control and other fields have been consistently productive. In particular, in the course of these collaborations, a widening appreciation of the principles of control has been apparent. Wherever dynamics and feedback are involved—and they are increasingly recognized as pervasive properties of complex systems—control expertise is regarded as crucial. Control is also seen as the paragon of rigor and the systems perspective by experts in other disciplines, distinctions that are being exploited as larger-scale, safety-critical, and mission-critical systems are developed or envisioned.

But despite its accomplishments and promise, there's more to control technology than is typically appreciated—whether by its exponents, its beneficiaries, or others directly or indirectly associated with the field. To help illuminate the to-date and yet-to-come impact of control, in 2011 we edited *The Impact of Control Technology: Overview, Success Stories, and Research Challenges* (available at www.ieeecss.org/main/IoCT-report). A distinctive feature of this report is a set of 42 two-page, full-color flyers, each highlighting a specific achievement or research opportunity in the field. By adopting the flyer format we hoped to facilitate the appreciation of the variety of accomplishments and opportunities in the field, both within the controls community and by its stakeholders. We have been gratified by the response to the report and the flyers in particular.

This second edition consists entirely of 68 such flyers, which have again been solicited from control engineers and scientists worldwide. Similarly to the original report, they are presented in two parts: "Success Stories for Control" and "Challenges for Control Research." Topics covered include traditional, new, and emerging applications and technologies—energy systems, process control, automotive control, intelligent transportation systems, pharmaceuticals, smart buildings, cancer biology, medical devices, behavioral modeling, cyber-physical security and privacy, finance, and much else besides! Some technical details are included and, in all cases, the flyers also highlight the realized or anticipated societal/industrial benefit. Most of the flyers from the original report have been revised and new flyers have been added. We certainly make no claim to having exposed the impact of control in its entirety.

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Nevertheless, the significance and diversity of these contributions is an indication of how extensive the footprint of control truly is!

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