

## Robot Control [TC Spotlight]

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# Robot Control

By Cosimo Della Santina<sup>ID</sup>, Sylvia Herbert, Manuel Kepler, and Kaoru Yamamoto

The field of modeling and control has long been foundational to advancements in robotics and automation. Despite its pivotal role, there is a discernible decline in engagement within this crucial area, particularly among emerging researchers. This spotlight article introduces the newly formed Technical Committee (TC) on Robot Control (RC). This TC is committed to reversing this trend by emphasizing the enduring significance of *foundational control* disciplines within the IEEE Robotics and Automation Society (RAS).

## INTRODUCTION

With the TC on RC, we aim to foster modeling, simulation, and control professionals, revitalizing their significance in academia and industry. Meanwhile, we strive to preserve an invaluable body of knowledge in mechanical systems and control theory, which is at risk of being forgotten by the community. Control theory remains the backbone of reliable, efficient, and safe robotic systems. As robotics applications expand into critical domains such as autonomous vehicles, health care, industrial automation, and national security, robust control frameworks are indispensable. Furthermore, in the era of data-driven and artificial intelligence (AI)-enhanced robotics, the integration of control principles ensures that systems are not only intelligent but also stable, predictable, and trustworthy.

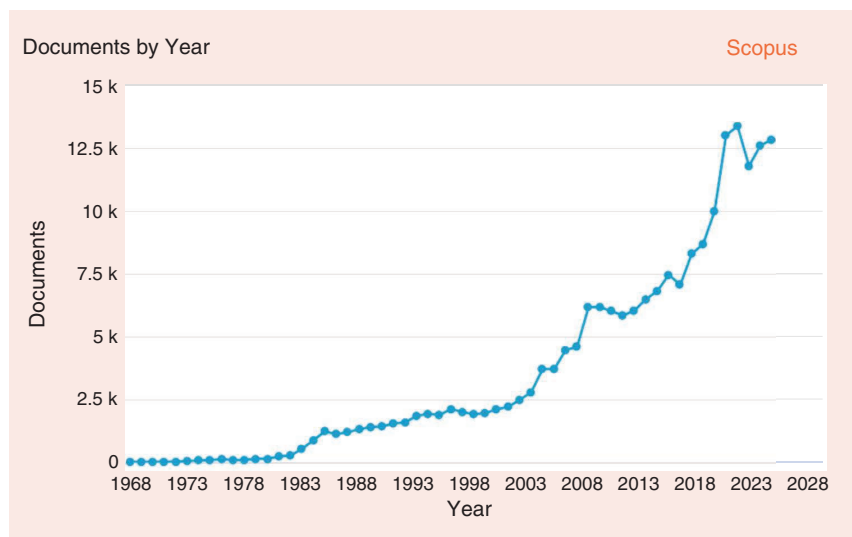
Continued advancements in control are imperative to ensure the sustainability of rapid progress in robotics, thereby safeguarding both commercial innovation and public safety.

## ARE WE IN A ROBOT CONTROL WINTER?

We have seen from the infamous “AI winter” that periods of lull can lead to a brain drain in important and challenging topics in research; we aim to mitigate this risk in the field of modeling and control. [Figure 1](#) illustrates the annual publication trends in RC research from 1968 to 2024. Initially, publications rose steadily but modestly until

a significant increase began in 1998, peaking in 2008. This was followed by a decline until 2013 when a second peak occurred in 2018. Subsequently, there is again a downturn, which continues to this day.

The downhill trend of RC in the RAS is also evident in conference programs, where scholars in this field find themselves fragmented in unrelated sessions. A sense of discouragement prevails among researchers and practitioners of RC, especially among younger generations. They feel marginalized in major conferences and academic discourse, creating a narrative that sidelines their contributions.



**FIGURE 1.** The number of articles identified in Scopus in a query using the words “Robot Control,” anywhere in the text. Almost no article or paper was identified before 1967. We limit our search to 2024 as 2025 is ongoing. The graph reveals an interesting nonmonotonic trend. k: thousand. (Source: Copyright 2025 Elsevier B.V. All rights reserved. Scopus is a registered trademark of Elsevier B.V.)

While the field of RC shows signs of declining engagement, this is not due to a lack of research activity but rather to a shift in how control methodologies are embedded in different subfields of robotics. This dispersion risks diluting the identity and recognition of control as a foundational discipline, potentially leading to a loss of critical theoretical knowledge and making it harder for new researchers to find their community.

### UNITING THE ROBOT CONTROL COMMUNITY: AN URGENT CALL TO ACTION

Although sessions explicitly labeled with “control” have declined in relative share [1], this does not tell the whole story. Many sessions in growing subject areas can be partly classified under the control domain, suggesting that RC is not losing ground—indeed, it may be expanding. An analysis of the *IEEE Robotics and Automation Letters (RA-L)* subject areas, which organize all RA-L keywords, shows that 13 of 20 areas include at least one keyword containing “control.” This under-

scores the diversification of RC into multiple subdisciplines. Even among the remaining eight areas, topics like Human-Robot Interaction and Manipulation and Grasping have deep roots in RC. Specifically, “control” appears within the following RA-L subject areas:

Aerial and Field Robotics; Autonomy for Mobility and Manipulation; Cognitive Robotics; Humanoids and Animaloids; Automation and Logistics; Manufacturing, Process, and Service Automation; Mechanisms, Design, and Control; Planning and Simulation; Robot Learning; Soft Robotics; Theoretical Foundations; and Vision and Sensor-Based Control.

This dispersion of control practitioners across multiple areas often leaves individual researchers—particularly early-career scholars focused on narrow domains—feeling isolated and concerned that their work might be perceived as peripheral or outdated. This widespread integration has led to a dispersion of control practitioners across various fields. While this diversification reflects the adaptability of the field, it often leaves individual researchers—especially early-career scholars focused on specialized domains—feeling isolated and concerned that their contributions will be perceived as peripheral or outdated. Recognizing this fragmentation, there



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is an urgent need to establish a united RC community—a dedicated forum to share ambitions, exchange knowledge, and collaborate on advancing both the theoretical foundations and practical applications of RC. Although creating such a community is a significant undertaking, it promises considerable benefits. It can reinvigorate the field, attract

new researchers, and demonstrate to both industry and the broader public the importance of RC.

### TC ON ROBOT CONTROL

We focus on preserving, disseminating, and advancing knowledge in modeling, simulation, and control of mechanical systems—ensuring its relevance and practical application. The TC will initiate and support platforms such as specialized workshops at leading conferences and foster educational programs, including Ph.D. schools, to pass on critical knowledge to the next wave of researchers. Our scope is to facilitate a vibrant and inclusive discourse that revitalizes the field of mod-

eling and control, empowering emerging researchers to embrace and expand upon these disciplines as they shape the future of robotics research.

We aim to amplify voices advocating for foundational RC principles and their role in robotics. We propose reintroducing dedicated RC sessions to counteract the fragmentation of the community and enhance its visibility. We seek to prevent the exodus of talented minds from academia by dispelling the misconception that their field is outdated and lacks a future.

Furthermore, we believe that incentivizing RC research will enhance the inclusivity of the RAS community. Compared to other branches of robotics, RC research requires fewer investments, allowing broader participation from groups with limited access to funding for costly equipment and computational resources.

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### REFERENCE

[1] B. Olofsson and A. Stolt, “Project in history of control: The history of robot control,” Lund University, Lund, Sweden, 2012. [Online]. Available: [https://archive.control.lth.se/media/Education/DoctorateProgram/2012/HistoryOfControl/Andreas\\_Bjorn-Robotics-Slides.pdf](https://archive.control.lth.se/media/Education/DoctorateProgram/2012/HistoryOfControl/Andreas_Bjorn-Robotics-Slides.pdf)

