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FOREWORD

The *Proceedings of the 1986 IEEE International Conference on Robotics and Automation* presents both reviewed and invited papers contributed to this conference. About 70 percent of the papers are reviewed contributed papers. The number of papers included in this proceedings indicates an impressive increase of interest in the fast developing field of robotics and automation. The proceedings of the first conference (in 1984) in this new IEEE conference series, sponsored by the IEEE Council on Robotics and Automation, contained 75 papers. The proceedings of the second conference in 1985 contained 167 papers. This 1986 conference has 340 papers on the program, presented in seven parallel sessions in three days.

The increased research and development interest in robotics and automation is being manifested not only by the number of papers presented at the conference but also by the diversified topics of the papers, the variety of approaches discussed in the papers, the widening geographic and institutional distribution of the authors both in the U.S.A. and abroad, and the depth of the papers. This conference also shows a stipulated and welcome increase of the number of research papers and topics concerning flexible automation in manufacturing and its relation to robotics. The program contains 60 papers in the area of flexible automation in manufacturing and production systems.

The papers presented at this conference cover practically all aspects of robotics. The program includes papers on: robot arm kinematics, dynamics, control and simulations; computer vision; robot sensing; robot hands; robot programming languages, operating systems, representation, planning and man-machine interfaces; multiple robot arm systems; mobile robots; robot applications in industry, space, etc. The papers presented on flexible automation in manufacturing cover: planning and scheduling, performance modeling, expert control systems, machining simulation and programming, and automated material handling.

The papers once again show that robotics and automation are inherently interdisciplinary fields, and to solve problems requires a close interaction of several disciplines like electrical, mechanical, control, and industrial engineering; material science; mathematics; and computer science and computer engineering. The papers also show the need for a broader and deeper recognition of the system aspects of robotics and automation for creating intelligent robotic and automated systems enhancing productivity, enabling work at remote or dangerous places, and improving the quality of human life.

It is our hope that this, as well as the past and future conferences in this series, will contribute to a broadened and deepened technical communication between the various research interests and groups in robotics and automation and will serve as a forum for interaction among the different disciplines.

We thank all conference committee members who graciously contributed their time and effort to help prepare and organize this conference. But above all we thank all authors who did the research, wrote the papers, and came to San Francisco to present their results to the research community.

Antal K. Bejczy
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8:30-10:10 a.m.	Session 1–1A **Manipulator Simulations & Solution**	Session 2–1A **Robot Dynamics and Control**	Session 3–1A **Control Mechanization**
10:10-10:40 a.m.	COFFEE BREAK		
10:40 a.m.-12:20 p.m.	Session 1–1B **Adaptive Manipulator Control**	Session 2–1B **Manipulator Dynamics**	Session 3–1B **Advanced Control Techniques I**
12:20-2:00 p.m.	LUNCH BREAK		
2:00-3:40 p.m.	Session 1–1C **Flexible Manipulators Modeling & Control**	Session 2–1C **Robot Task Controls**	Session 3–1C **Advanced Control Techniques II**
3:40-4:10 p.m.	COFFEE BREAK		
4:10-5:50 p.m.	Session 1–1D **Robot Manipulators Hands**	Session 2–1D **Robust and Variable Controls**	Session 3–1D **Multivariable Control Planning and Optimization**

WEDNESDAY, April 9, 1986

8:30-10:10 a.m.	Session 1–2A **Robot Kinematics I**	Session 2–2A **Sensing and Control**	Session 3–2A **Robot Control Methods**
10:10-10:40 a.m.	COFFEE BREAK		
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2:30-4:10 p.m.	Session 1–2C **Robot Parameters**	Session 2–2C **Modeling and Control of Flexible Robots**	Session 3–2C **Robot Motion and Planning**
4:10-4:30 p.m.	COFFEE BREAK		
4:30-6:10 p.m.	Session 1–2D **Robot Kinematics II**	Session 2–2D **Dynamics and Control**	Session 3–2D **Multi-Robot Motion Coordination**

THURSDAY, April 10, 1986

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10:10-10:40 a.m.	COFFEE BREAK		
10:40 a.m.-12:20 p.m.	Session 1–3B **Robot Hands II**	Session 2–3B **Robot Control**	Session 3–3B **Planning in the Presence of Uncertainty**
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2:00-3:40 p.m.	Session 1–3C **New Results in Robot Mechanisms Design and Control**	Session 2–3C **Computation Systems for Robotics and Automation**	Session 3–3C **Path Planning**
3:40-4:10 p.m.	COFFEE BREAK		
4:10-5:50 p.m.	Session 1–3D **Robot Analysis Simulation**	Session 2–3D **Automation Controller Architectures and Programming**	Session 3–3D **Constraints and Optimization in Planning**
6:00-7:30 p.m.	CLOSING RECEPTION — Continental Ballroom		

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