William Holderbaum · J. M. Selig
Editors

2nd IMA Conference on Mathematics of Robotics

Springer

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Preface

This volume represents the proceedings of the Second IMA Conference on Mathematics of Robotics. This conference was originally to be held in Manchester, in September 2020, but was postponed because of the SARS-CoV-2 pandemic. The conference was eventually held online from 8 to 10 September 2021.

The first conference in this series was held in 2015 at St. Anne's College, Oxford. This attracted almost 30 submissions which can be found at the URL: https://ima.org.uk/proceedings-ima-conference-mathematics-robotics/.

The IMA also sponsored a similar conference in July 1989; this was titled "Robotics: Applied Mathematics and Computational Aspects". The conference was held at Loughborough University and the proceedings published by Oxford University Press. This might be considered as the 0th edition of the conference.

The aim of the series is to bring together researchers working on all areas of robotics which have a significant mathematical content. The idea was to highlight the mathematical depth and sophistication of techniques applicable to robotics and to foster cooperation between researchers working in different areas of robotics.

Robotics is a practical discipline. It grew out of engineers' ability to build very sophisticated machines which combine computer control with electro-mechanical actuators and sensors. Any theory in the subject must take account of what is practically possible with real machines. Nevertheless, there must be a place for a theoretical side to the subject.

Of course, by definition theory is always useless, otherwise it wouldn't be theory! But surely, all disciplines recognise the need for sound theoretical underpinnings. The question really is whether the theoretical underpinnings of robotics are distinct or just a part of the general theory used in the disciplines that make up robotics. One cannot sensibly separate, say a theory of robot mechanisms from the general theory of mechanisms. However, there is something special about robotics and that is the central importance of rigid body displacements. That is not to say that theory not involving this Lie group is not robotics nor that other disciplines cannot profitably use this Lie group. It is just that this is a major theme running through much of robotics: the links of a robot are not really rigid, but to a first approximation they are. The motions allowed by the joints of the robot are rigid

body motions. The payload carried by the robot's end-effector is more often than not a rigid body. Standard analysis of the kinematics, dynamics and control of these robots all reflect this rigid body approach. In robot vision, a central problem is to find the rigid motion undergone by the camera using information derived from the images. Almost, all the contributions to the conference reflect this view to a greater or lesser extent.

The conference was organised in cooperation with the Society for Industrial and Applied Mathematics (SIAM), and we would like to thank Jonathan Hauenstein, our SIAM representative, for getting up early to attend our Organising Committee Meetings and for all his work on this project. We would also like to thank our other Committee Members, Victor Becerra and William Harwin, for their contributions. Finally, the conference could not have happened without the efforts of our IMA Conference Officer, Maya Everson.

September 2021

William Holderbaum
J. M. Selig

Organisation

Organising Committee

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