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# International Association of Geodesy Symposia

*Michael G. Sideris, Series Editor*

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# VII Hotine-Marussi Symposium on Mathematical Geodesy

Proceedings of the Symposium  
in Rome, 6-10 June, 2009

Edited by

Nico Sneeuw  
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## Preface

This volume contains the proceedings of the VII Hotine-Marussi Symposium on Mathematical Geodesy, which was held from 6 to 10 July 2009. The symposium took place at the Faculty of Engineering of the Sapienza University of Rome, Italy, in the ancient *chostro* of the Basilica of S. Pietro in Vincoli, famously known for its statue of Moses by Michelangelo.

The traditional name *mathematical geodesy* for the series of Hotine-Marussi Symposia may not fully do justice to the symposium's broad scope of theoretical geodesy in general. However, the name for the series has been used since 1965, i.e., the days of Antonio Marussi, which is a good reason to adhere to it. The venue of the Hotine-Marussi Symposia has traditionally been in Italy. The choice for Rome, if a reason is needed at all, was partially made because 2009 was the International Year of Astronomy. Two important astronomical events were commemorated: the publication of Kepler's *Astronomia Nova* in 1609, in which he published his first two laws of planetary motion, as well as the very first astronomical use of a telescope by Galileo and his discovery of Jupiter's moons. Besides one of the founding fathers of geodesy, the unit of Gal being named after him, he was one of the cofounders and an early member of the Accademia Nazionale dei Lincei in Rome. It was a pleasure, therefore, that a special session was organized by Fernando Sansò at the Villa Farnesina, located at the Academy. The special session was dedicated to the memory of Antonio Marussi (1908–1984), who was the driving force behind the series of Hotine (later Hotine-Marussi) Symposia.

Since 2006 the series is under the responsibility of the InterCommission Committee on Theory (ICCT), a cross-commission entity within the International Association of Geodesy (IAG). The overall goal of the Hotine-Marussi Symposia has always been the advancement of theoretical geodesy. This goal is aligned with the objectives of the ICCT, which has the developments in geodetic modeling and data processing in the light of recent advances of geodetic observing systems as well as the exchange between geodesy and neighboring Earth sciences as its central themes. Indeed, the current proceedings are testimony to the width and vibrancy of theoretical geodesy.

The symposium attracted 132 participants who contributed 75 papers (51 oral and 24 poster), organized in eight regular sessions plus the session at the Accademia Nazionale dei Lincei. To a large extent, the sessions' topics were modeled on the study group structure of the ICCT. The chairs of the ICCT study groups, who constituted the Symposium's Scientific Committee, were at the same time responsible for organizing the sessions:

1. *Geodetic sensor systems and sensor networks*  
S. Verhagen
2. *Estimation and filtering theory, inverse problems*  
H. Kutterer, J. Kusche
3. *Time series analysis and prediction of multi-dimensional signals in geodesy*  
W. Kosek, M. Schmidt
4. *Geodetic boundary value problems and cm-geoid computational methods*  
Y.M. Wang, P. Novák
5. *Satellite gravity theory*  
T. Mayer-Gürr, N. Sneeuw
6. *Earth oriented space techniques and their benefit for Earth system studies*  
F. Seitz, R. Gross
7. *Theory, implementation and quality assessment of geodetic reference frames*  
Dermanis, Z. Altamimi
8. *Temporal variations of deformation and gravity*  
G. Spada, M. Crespi, D. Wolf

We want to express our gratitude to all those who have contributed to the success of the VII Hotine-Marussi Symposium. The aforementioned study group chairs (Scientific Committee) put much effort in organizing attractive sessions and convening them. They also organized the peer review process. We equally owe thanks to all reviewers. Although much of the review process itself remains anonymous, the complete list of the reviewers is printed in this volume as a token of our appreciation of their dedication.

Financial and promotional support was given by a number of agencies and institutions. Special thanks go to Federazione delle Associazioni Scientifiche per le Informazioni Territoriali e Ambientali (ASITA), Agenzia Spaziale Italiana (ASI), the European Space Agency (ESA), and the Faculty of Engineering of the Sapienza University of Rome.

But most of all we like to thank Mattia Crespi and his team (Gabriele Colosimo, Augusto Mazzoni, Francesca Fratarcangeli, and Francesca Pieralice) who hosted the symposium. It is well known that the quality of a Local Organizing Committee (LOC) is decisive to a successful scientific meeting. Beyond responsibility for website, registration, technical support, and all kinds of other arrangements, the LOC organized a great social event to the St. Nilus' Abbey, the archeological area of Monte Tuscolo and the Villa Grazioli in Frascati. Through their able organization and improvisation skills, Mattia Crespi and his team have done more than their share in bringing the VII Hotine-Marussi Symposium to success.

Stuttgart

Nico Sneeuw  
Pavel Novák  
Mattia Crespi  
Fernando Sansò

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## Fifty Years of Hotine-Marussi Symposia

In 1959, Antonio Marussi, in cooperation with the Italian Geodetic Commission, started a series of symposia in Venice. The first three of these covered the entire theoretical definition of 3D Geodesy, as delineated in discussions with renowned contemporary scientists:

- 1959, Venice, 16–18 July, 1st Symposium on Three Dimensional Geodesy, published in *Bollettino di Geodesia e Scienze Affini*, XVIII, N° 3, 1959
- 1962, Cortina d'Ampezzo, 29 May-1 June, 2nd Symposium on Three Dimensional Geodesy, published in *Bollettino di Geodesia e Scienze Affini*, XXI, N° 3, 1962
- 1965, Turin, 21–22 April, 3rd Symposium on Mathematical Geodesy, published by Commissione Geodetica Italiana, 1966

From the very beginning, Martin Hotine provided essential inspiration to these symposia. After his death in 1968, the following symposia bear his name:

- 1969, Trieste, 28–30 May, 1st Hotine Symposium (4th Symposium on Mathematical Geodesy), published by Commissione Geodetica Italiana, 1970
- 1972, Florence, 25–26 October, 2nd Hotine Symposium (5th Symposium on Mathematical Geodesy), published by Commissione Geodetica Italiana, 1973
- 1975, Siena, 2–5 April, 3rd Hotine Symposium (6th Symposium on Mathematical Geodesy), published by Commissione Geodetica Italiana, 1975
- 1978, Assisi, 8–10 June, 4th Hotine Symposium (7th Symposium on Mathematical Geodesy), published by Commissione Geodetica Italiana, 1978
- 1981, Como, 7–9 September, 5th Hotine Symposium (8th Symposium on Mathematical Geodesy), published by Commissione Geodetica Italiana, 1981

After Marussi's death, in 1984, the symposia were finally named the Hotine-Marussi Symposia:

- 1985, Rome, 3–6 June, I Hotine-Marussi Symposium (Mathematical Geodesy)
- 1989, Pisa, June, II Hotine-Marussi Symposium (Mathematical Geodesy)
- 1994, L'Aquila, 29 May-3 June, III Hotine-Marussi Symposium (Mathematical Geodesy, Geodetic Theory Today), published by Springer, IAG 114
- 1998, Trento, 14–17 September, IV Hotine-Marussi Symposium (Mathematical Geodesy), published by Springer, IAG 122
- 2003, Matera, 17–21 June, V Hotine-Marussi Symposium (Mathematical Geodesy), published by Springer, IAG 127
- 2006, Wuhan, 29 May-2 June, VI Hotine-Marussi Symposium (Theoretical and Computational Geodesy, 1st time under ICCT), published by Springer, IAG 132
- 2009, Rome, 6–10 June, VII Hotine-Marussi Symposium (Mathematical Geodesy), published by Springer, IAG





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