The 28th International Conference on Applications of Computer Algebra ACA'2023

PROGRAM & ABSTRACTS

Warsaw University of Life Sciences – SGGW
Institute of Information Technology
July 17 – 21, 2023

WWW: https://aca2023.iit.sggw.pl

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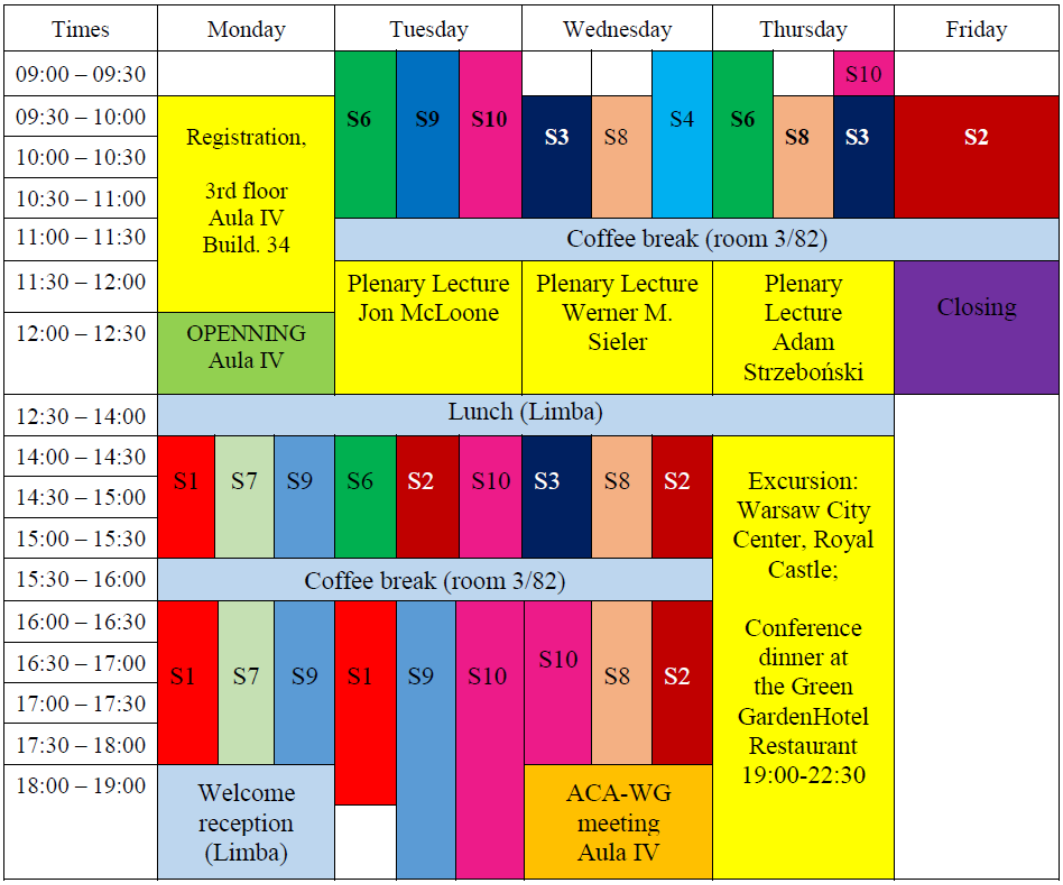
ACA2023 – General Schedule



S1 – Computer Algebra in Education
S2 – Computer Algebra Modeling in Science and Engineering
S3 – D-Finite Functions and Beyond: Algorithms, Combinatorics and Arithmetic
S4 – Computer Algebra Systems and Interval Methods
S6 – Computer Algebra Applications in the Life Sciences
S7 – Computational Differential and Difference Algebra and its Applications
S8 – Algebraic Geometry from an Algorithmic Point of View
S9 – Effective Ideal Theory and Combinatorial Techniques in Commutative and Non-Commutative Rings and Their Applications
S10 – Algebraic and Algorithmic Aspects of Differential and Integral Operators

Schedule for Invited Talks

Tuesday, July 18, 2023

Build. 34, 3d floor, Lecture Hall "Aula IV"

11:30 – 12:30 **Jon McLoone**
Wolfram's Vision for Unified Computation

Wednesday, July 19, 2023

Build. 34, 3d floor, Lecture Hall "Aula IV"

11:30 – 12:30 **Werner M. Seiler**
Theoretical and Numerical Analysis of Singular Initial and Boundary Value Problems

Thursday, July 20, 2023

Build. 34, 3d floor, Lecture Hall "Aula IV"

11:30 – 12:30 **Adam Strzebonski**
Recent Symbolic Computation Developments in Mathematica

Contents

D-Finite Functions and Beyond: Algorithms, Combinatorics and Arithmetic

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Algebraic Geometry from an Algorithmic Point of View

Effective Ideal Theory and Combinatorial Techniques in Commutative and Non-Commutative Rings and Their Applications

Algebraic and Algorithmic Aspects of Differential and Integral Operators

Applications of Computer Algebra – ACA'2023
Warsaw, Poland | July 17 – 21, 2023
Session on *"Computer Algebra Modeling in Science and Engineering"*

The problem of many bodies with isotropically varying masses

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The number of confirmed exoplanetary systems is more than 4000 to date [1] and it is growing up every day. The parent star and exoplanets are non-stationary [2]. It means that the investigation of a multi-planetary system with variable masses is actual in celestial mechanics and astronomy. Due to the non-stationarity of celestial bodies, the mathematical model of their motion becomes more complicated.

In the present talk, we investigate the dynamic evolution of the system of many bodies with isotropically varying masses. We apply the method of canonical perturbation theory developed for solutions of such non-stationary problems in [3]. Doing quite cumbersome symbolic calculations with the computer algebra system Wolfram Mathematica [4], we calculated the perturbing function in the form of power series in small parameters (analogues of eccentricities and inclinations). Averaging the perturbing function over the mean longitudes and computing its derivatives with respect to the canonical variables, we derived the evolution equations describing the secular perturbations of the orbital elements in analytical form [5]. As an example, we have considered the K2-3 exoplanetary system (see [6]) and obtained numerical solutions of the evolution equations.

Keywords: four body problem, variable mass, dynamic evolution, secular perturbations

Acknowledgments
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References
[1] EXOPLANET EXPLORATION, *url:https://exoplanets.nasa.gov/.* Last update: May 11, 2023.
[2] T.B. OMAROV, Non-Stationary Dynamical Problems in Astronomy. *New-York: Nova Science Publ.Inc. P.260. ISBN:1-59033-331-4*, (2002).

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