Scientific Program of SCAN 2020

**Monday, September 13**

9:20 - 10:00 - **Plenary session**, chair: Shin’Ichi Oishi

Kazuaki Tanaka: Verification of the sign of solutions to elliptic partial differential equations

10:00 - 10:20 - Coffee break

10:20 - 12:00 - Parallel sessions (2 \* 4 talks)

**Session A: PDE,** chair: Shin’Ichi Oishi

Shin'Ichi Oishi and Kouta Sekine: Inverse Bifurcation Diagram Problem of Forced El Nino Equation

Yuuki Saito, Naoki Takamatsu, Shin'Ichi Oishi and Kouta Sekine: Inverse bifurcation diagram problem for delayed van der Pol-Duffing equation

Jonathan Wunderlich: Computer-assisted Existence Proofs for Navier-Stokes Equations on an Unbounded Strip with Obstacle

Akitoshi Takayasu and Jean-Philippe Lessard: A rigorous forward integration method for time-dependent PDEs

**Session B: Arithmetic and Implementation,** chair:Shinya Miyajima

Shinya Miyajima: Verified bounds for matrix gamma function

Tomoaki Okayama and Shota Ogawa: Improvement of selection formulas of mesh size and truncation number for the DE-Sinc approximation and its theoretical error bound

Naoya Yamanaka and Takeo Uramoto: Verified algorithm for high-order partial derivatives using nilpotent matrix

Shinya Miyajima: Computing enclosure for matrix real powers

12:00 - 13:00 - Lunch break

13:00 - 13:50 - Parallel sessions (2 \* 2 talks)

**Session A: Dynamic Systems,** chair:Tibor Csendes

Alexander Morozov and Dmitry Reviznikov: Kd-tree based adaptive interpolation algorithm for modeling dynamic systems with interval parameters

Anna Gierzkiewicz and Piotr Zgliczynski: The Sharkovskii Theorem for multidimensional maps with attracting periodic orbits

**Session B: Application and Software,** chair:Ekaterina Auer

Ekaterina Auer and Wolfram Luther: Assessing Uncertainty in Hereditary Risk Models for BRCA1/2 Related Cancer

Ekaterina Auer, Lorenz Gillner, Wolfram Luther and Andreas Rauh: VERICOMP 2.0: Comparing and Recommending Verified IVP Solvers in a Flexible Way

13:50 - 14:10 - Coffee break

14:10 - 15:25 - Parallel sessions (2 \* 3 talks)

**Session A: Optimization,** chair: Ralph Baker Kearfott

Mihály Csaba Markót: Interval methods for packing problems on the sphere

Dun Liu and Ralph Baker Kearfott: On Convexity Density and Difficulty of Global Optimization Problems

David Sanders and Valentin Churavy: Interval constraint propagation and branch-and-bound-type methods on the GPU using Julia

**Session B: Arithmetic and Implementation,** chair: Vladik Kreinovich

Tamás Dózsa: Inverses of Rational Functions

Mantas Mikaitis: A Trick for an Accurate e^(−|x|) Function in Fixed-Point Arithmetics

Vladik Kreinovich, Olga Kosheleva and Victor Selivanov: Kinematic Metric Spaces Under Interval Uncertainty: Towards an Adequate Definition

**Tuesday, September 14**

9:00 - 9:40 - **Plenary session,** chair:Nathalie Revol

Fabienne Jézéquel: Benefits of stochastic arithmetic in high performance simulations and arbitrary precision codes

9:40 - 10:00 - Coffee break

10:00 - 11:40 - Parallel sessions (2 \* 4 talks)

**Session A: Dynamic Systems,** chair:Nobito Yamamoto

Taisei Asai, Kazuaki Tanaka, Kouta Sekine and Shin'Ichi Oishi: Computer-assisted analysis for bifurcation diagrams of the one-dimensional Henon equation

Naoki Takamatsu, Yuuki Saito, Shin’ichi Oishi and Kouta Sekine: Numerical verification of existence for subharmonic solutions to delayed van der Pol-Duffing equation

Nobito Yamamoto and Koki Nitta: A numerical verification method on time-global solutions of autonomous systems of complex functions

Kaname Matsue: Rigorous numerics of blow-up separatrix in autonomous ODEs

**Session B: Algorithms,** chair:Andreas Rauh

Takehiko Kinoshita, Yoshitaka Watanabe and Mitsuhiro T. Nakao: On some convergence properties for finite element approximations to the inverse of linear elliptic operators

Xuefeng Liu: Rigorous maximum norm estimation for polynomial systems

Ekaterina Auer and Andreas Rauh: Parameter Identification for Cooperative SOFC Models on the GPU

Marco De Angelis: Linear-time algorithm for interval uncertainty propagation through the discrete Fourier transform

11:40 - 13:00 - Lunch break

13:00 - 14:15 - Parallel sessions (2 \* 3 talks)

**Session A: Dynamic Systems,** chair:Tibor Krisztin

Andreas Rauh and Rachid Malti: Quantification of Time-Domain Truncation Errors for the Reinitialization of Fractional Integrators

Tibor Krisztin and János Dudás: Global stability for the three-dimensional logistic map

Ferenc Agoston Bartha, Tibor Krisztin and Alexandra Vígh: Stable periodic orbits for the Mackey–Glass equation

**Session B: Algorithms,** chair:Elena Chausova

Imre Fekete: Local error estimation and step size control in adaptive linear multistep methods

Elena Chausova: The inventory control problem for a supply chain with a mixed type of demand uncertainty

Auguste Bourgois, Amine Chaabouni, Andreas Rauh and Luc Jaulin: Proving the stability of navigation cycles

14:15 - 14:35 - Coffee break

14:35 - 15:25 - Parallel sessions (2 \* 2 talks)

**Session A: Artificial Intelligence,** chair: Tibor Csendes

Tibor Csendes, Nándor Balogh, Balázs Bánhelyi, Dániel Zombori, Richárd Tóth and István Megyeri: Adversarial Example Free Zones for Specific Inputs and Neural Networks

Jonatan Contreras, Martine Ceberio and Vladik Kreinovich: Why rectified linear neurons: a possible interval-based explanation

**Session B: Optimization,** Chair: Boglárka G.-Tóth

Leocadio G. Casado, Boglárka G.-Tóth, Frédéric Messine and E.M.T. Hendrix: Directional derivative bounds and border facets in simplicial B&B monotonicity tests

Bartlomiej Kubica: How many constraints are satisfied? An approach to solving classification and regression problems

Wednesday, September 15

9:00 - 9:50 - Parallel sessions (2 \* 2 talks)

**Session A Numerical Linear Algebra,** chair:Katsuhisa Ozaki

Katsuhisa Ozaki: Error-free transformation of matrix multiplication for multi-precision computations

Matyáš Lorenc: B-matrices and their generalizations in the interval setting

**Session B: Artificial Intelligence,** chair: Balázs Bánhelyi

Dániel Zombori, Tamás Szabó, János Horváth, Attila Szász, Tibor Csendes and Balázs Bánhelyi: Verification of artificial neural networks via Taylor models of INTLAB

Dániel Zombori, Tamás Szabó, János Horváth, Attila Szász, Tibor Csendes and Balázs Bánhelyi: Verification of artificial neural networks via MIPVerify and SCIP

9:50 - 10:10 - Coffee break

10:10 - 11:25 - Session (1 \* 3 talks)

**Session A: Arithmetic and Implementation,** chair: Nathalie Revol

Nathalie Revol: Convergent Real Matrix Powers with Divergent Results in Interval Arithmetic

Massimiliano Fasi and Mantas Mikaitis: CPFloat: A C library for emulating low-precision arithmetic

Sergey Kumkov: Information Sets in a Data Fitting Problem for Criteria of Strong and Weak Compatibility under Heavy Two-Dimensional Measuring Errors

11:40 - 13:00 - Lunch break

13:00 - 13:50 - Session (1 \* 2 talks)

**Session A: Algorithms,** chair: Sergey Shary

Sergey Shary: Variability measures for estimates in interval data fitting

Vladik Kreinovich and Sergey Shary: How probabilistic methods for data fitting deal with interval uncertainty: a more realistic analysis

13:50 - 14:10 - Coffee break

14:10 - 14:50 - **Plenary session**, chair: Jean-Philippe Lessard

Jason Mireles James: Computer assisted proofs for connecting orbits in infinite dimensions

14:50 - 15:50 - **Moore Prize laudation and talk,** chair: Vladik Kreinovich

Marko Lange and Siegfried M. Rump: Verified inclusions of a nearest matrix of specified rank via a generalization of Wedin's sin (θ) theorem