

R. E. Moore Prize for Applications of Interval Analysis: A Brief History

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1. Rationale

- By the late 1950's, the use of digital electronic computers for mathematical computations have started to be exponentially increasing.
- Interval arithmetic was a concept whose time had come.
- Prof. Ramon Moore was one of the first to develop the underlying principles of interval arithmetic in their modern form.
- This was presented in his 1962 dissertation *Interval Arithmetic and Automatic Error Analysis in Digital Computing*.
- This dissertation was encouraged by George Forsythe.
- Prof. Moore subsequently dedicated much of his life to furthering the subject.

2. Rationale (cont-d)

- This includes:
 - guidance of seven Ph.D. students,
 - interaction with other prominent figures in the area such as Eldon Hansen, Louis Rall, and Bill Walster, and
 - publication of the seminal work *Interval Analysis* (Prentice Hall, 1966).
- This book was updated twice:
 - to *Methods and Applications of Interval Analysis* (SIAM, 1979) and
 - to *Introduction to Interval Analysis* (SIAM, 2009).

3. Rationale (cont-d)

- In addition, Prof. Moore:
 - published a related book *Computational Functional Analysis* (Horwood, 1985), and
 - organized the conference with proceedings *Reliability in Computing* (Academic Press, 1988).
- This latter conference was a major catalyst for renewed interest in the subject.
- It is safe to say that these accomplishments of Professor Moore have made interval analysis what it is today.
- In 2002, the Editorial Board of *Reliable Computing* decided to dedicate to Prof. Moore a biennial prize.

4. Rationale (cont-d)

- *Reliable Computing* is:
 - an International Journal
 - devoted to reliable mathematical computations based on finite representations and guaranteed accuracy.
- This prize is awarded to the best dissertation or paper in applications of interval analysis.
- The editorial board of the journal *Reliable Computing* judges this award.
- By “applications” we intend primarily:
 - applications in engineering and sciences
 - that will bring further recognition to the power of interval computations.
- However, we do not wish to rule out significant and widely recognized “pure” applications.

5. The first R. E. Moore Prize

- The first R. E. Moore Prize was awarded in 2002 to Dr. Warwick Tucker from Cornell University.
- He proved, using interval techniques, that the renowned Lorenz equations do in fact possess a strange attractor.
- This problem was known as Smale's 14th conjecture.
- It is of particular note in large part because the Lorenz model is widely recognized as signaling the beginning of chaos theory.

6. The second R. E. Moore Prize

- The second prize was awarded in 2004 to Professor Thomas C. Hales.
- He solved solution of the Kepler conjecture about the densest arrangement of spheres in space.
- Dr. Hales solved this long-standing problem by using interval arithmetic.

7. The third R. E. Moore Prize

- The third prize was awarded in 2008 to Dr. Kyoko Makino and Dr. Martin Berz.
- They were awarded for their paper “Suppression of the wrapping effect by Taylor model-based verified integrators: long-term stabilization by preconditioning”.

8. The fourth R. E. Moore Prize

- The fourth prize was awarded to in 2012 to Dr. Luc Jaulin.
- He was awarded for his paper “A nonlinear set-membership approach for the localization and map building of an underwater robot using interval constraint propagation”.

9. The fifth R. E. Moore Prize

- The fifth prize was awarded in 2014 to Dr. Kenta Kobayashi.
- He was awarded for his paper “Computer-assisted uniqueness proof for Stokes’ wave of extreme form”.

10. The sixth R. E. Moore Prize

- The sixth prize was awarded in 2016 to Drs. Balazs Banhelyi, Tibor Csendes, Tibor Krisztin, and Arnold Neumaier.
- They were awarded for their paper “Global attractivity of the zero solution for Wright’s equation”.

11. The seventh R. E. Moore Prize

- The seventh prize was awarded in 2018 to Drs. Jordi-Lluís Figueras, Alex Haro, and Alejandro Luquez.
- They were awarded for their paper “Rigorous computer-assisted application of KAM theory: a modern approach”.

12. The eighth R. E. Moore Prize

- The eighth prize was awarded in 2021 to Drs. Marko Lange and Siegfried Rump.
- They were awarded for their paper “Verified inclusions for a nearest matrix of specified rank deficiency via a generalization of Wedin’s $\sin(\theta)$ theorem”.

13. The ninth R. E. Moore Prize

- The ninth prize was awarded in 2025 to Drs. Tristan Buckmaster, Gonzalo Cao-Labora, and Javier Gomez-Serrano.
- They were awarded for their paper “Smooth imploding solutions for 3D compressible fluids”.