Preface

Archimedes in the 21st Century, a two-day world conference held in Spring 2013 at the Courant Institute of Mathematical Sciences, New York University, took place during what is believed to have been Archimedes' 2300th birth year.

This conference was focused on the enduring and continuing influence of Archimedes in our modern world. Specifically, it celebrated his 23 centuries of influence on mathematics, science, and engineering.

Courant Institute Director Gérard Ben Arous opened the conference with this inspiring observation:

> I'm impressed by the idea that, 23 centuries after his lifetime, we're still looking at the influence of Archimedes in our modern world. It's as close a shot at immortality as one can imagine.

Eight invited talks presented during the first day of the conference are printed in this volume. The conference speakers were chosen because they are actively involved in fields whose origins trace back to Archimedes. As well, many of the presenters have conducted and published research that extends Archimedes' work in the twenty-first century.

The fields of mathematics, science, and engineering each claim Archimedes as one of their own. For that reason, the conference talks were divided into three categories: *Archimedes the Mathematician/Geometer*, *Archimedes the Scientist*, and *Archimedes the Engineer*.

Let me say a few words about what the conference *was not.*

Archimedes in the 21st Century was *not* a history of science conference, and therefore, no historians of science were invited to present. That was certainly no slight to the importance of the work of historians of science; many other conferences have emphasized that aspect of Archimedean scholarship (e.g., [1]).

An example surrounding this distinction is the *Archimedes Palimpsest*, which is mentioned only tangentially in these conference proceedings. This collection of works of Archimedes, hidden beneath the text of a prayer book sometime in the thirteenth century, was unveiled and edited by Heiberg in 1906 [2] and analyzed with modern technology in the last twenty years [3]. Its discovery was of immense

value to historians, but its mathematical results had to be rediscovered independently in the sixteenth and seventeenth centuries by the pioneers of the mathematical Renaissance. Had its contents not been obscured in the thirteenth century, it could have had a significant influence on twenty-first-century mathematics and science. But the window of opportunity for the palimpsest came and went, and so humankind took a different path in the tree of possibilities.

Our conference drew an audience of mathematicians, scientists, and engineers who were primarily interested in learning about the latest twenty-first-century applications of Archimedes' works—along with their historical roots. Individuals already familiar with the history of Archimedes who were interested in learning what his works have led to in the twenty-first century also attended our conference.

As conference organizer and editor of these proceedings, I would now like to speak personally about our distinguished speakers:

Moshe Kam is the quintessential professional engineer and historian of science, a university dean of engineering, and a former president of IEEE (Institute of Electrical and Electronics Engineers). Moshe was our opening speaker, and he presented a complete and thoughtful timeline of engineering from ancient times to the twenty-first century, highlighting Archimedes' contributions to the field.

Larrie D. Ferreiro is an authority on military strategies and weaponry, a historian of naval architecture, a university professor of systems engineering, and an author of several books and many articles on these themes. Larrie's focus on *defense in depth* was astute and compelling, particularly when he applied Archimedean ideas to twenty-first-century military stratagems [4].

Mamikon Mnatsakanian is the developer of *Visual Calculus*, an ingenious approach to solving many problems in geometry and integral calculus. He is the coauthor of a recently published geometry work that provides fresh and powerful insights to that field [5]. His richly illustrated conference talk brought Archimedes' renowned *tombstone theorem* into the twenty-first century, extending it in numerous directions.

Horst Nowacki is a world authority on naval history and the author of *Archimedes and Ship Stability* [6]. Having extensively consulted with Horst during my own floating-bodies research [7, 8], I commend his encyclopedic knowledge of Archimedean laws as they have been applied to ship design over two millennia.

Dirk M. Nuernbergk is a world expert on the Archimedes Screw, particularly for the newest twenty-first-century application of operating Archimedes screws *in reverse* over rivers and streams in order to generate cheap electricity. This application is proving to be a boon all across Europe, Canada, and New Zealand. Dirk is at the center of this innovative research, both as a consultant engineer and as the author of numerous engineering journal articles; he has also written a handbook for setting up a hydropower screw [9].

Michael T. Wright is an ancient technology scholar and a mechanician who brought two of his handwrought models to our conference: the much-acclaimed Antikythera Mechanism and his newly created *Sphere of Archimedes*—which he unveiled in public for the first time at the conclusion of his talk. Michael's *Sphere* is the first model of

an Archimedes' sphere that anyone in any century has ever attempted to reconstruct; it is a clear precursor of our modern-day planetarium and a marvel to behold.

Mary Jaeger was the only invited non-STEM presenter at our conference. She is the author of the scholarly volume, *Archimedes and the Roman Imagination* [10], and presented the classicist's perspective. In her well-researched talk, Mary chronicled events and people who have brought Archimedes into our modern world—surprisingly (and sometimes amusingly) perpetuating the anecdotes and myths about him.

At this conference, I presented the *Archimedes the Mathematician* segment along with Sylvain Cappell, Silver Professor of Mathematics at the Courant Institute of Mathematical Sciences.

You can view videos of all the Archimedes conference talks and learn more about the greatest mathematician and scientist of antiquity on my Archimedes website:

https://www.cs.drexel.edu/~crorres/Archimedes/AWC/

This site is the repository of my 50-year fascination with Archimedes. In it I've compiled knowledge about his inventions, the numerous fields of science and mathematics he engendered, discussions of many of his finished works, and my own research that extends and applies Archimedean principles to twenty-first-century problems. I created this website in 1995, and it has been under continual development and expansion since then.

Acknowledgments

I wish to thank all our speakers, both Friday and Saturday, for their thoughtful and inspiring presentations. Thanks, particularly, to my Drexel colleague, structural engineer Harry Harris, who transported his remarkable 1/60-scale working model of an Archimedes Claw/Iron Hand to the conference and spoke about it during our Saturday session.

I am very grateful to our sponsors who made the conference possible: First, the Courant Institute of Mathematical Sciences for hosting the conference and for providing guidance and support. Among my colleagues at Courant, I warmly thank Sylvain Cappell and Gérard Ben Arous.

Similarly, I want to thank the directors of the Institute of Electrical and Electronics Engineers (IEEE) for providing the lead grant for this conference; most especially, I thank Moshe Kam for helping us qualify for the IEEE grant.

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Also, a warm thank-you to professional staffers at NYU who helped plan, manage, and promote the conference, specifically James Devitt of NYU's Media Relations Department for disseminating communications about the Archimedes conference to the news media and to the greater NYU community, and Elizabeth

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My sincere and personal thanks to Susanna Davison and Rene Saxman for managing the conference registration and to Demos Vasiliou for providing sustenance for our conference reception.

And finally, I wish to thank my wife Billie who was co-organizer of the conference and coeditor of these proceedings, but who declined to be listed as such. (I should have insisted a little harder.)

Chris Rorres
April 2017

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Following is reprinted an article about our conference that appeared in *The New York Times*. It was written by science reporter Kenneth Chang, who attended both days of the conference. The article appeared in the June 25, 2013, *Science Times* section of the *NYT* and is reprinted here with permission.

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