

## Preface to the Proceedings

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A conference on *Algebra, Arithmetic, Geometry, and its Applications* was held at Purdue University, to celebrate the seventieth birthday of Professor Shreeram Abhyankar. This conference was held between the 20th and 26th, of July, 2000; close to one hundred mathematicians participated, and over sixty of them presented their work. This volume contains papers from several of the participants, and some others who could not make it to the conference. The conference was supported by contributions from: Bell Labs, The office of Naval Research, The School of Science - Purdue University, and The Department of Mathematics - Purdue University. We sincerely thank Professor Carl Cowen, Head of the Department of Mathematics, Purdue University, the administrative staff of the department, and Ms. Susan Umberger, Purdue Conferences, for all their help. Without their help and dedication the conference would not have been possible. In addition, our sincere thanks to Professor Bajaj and Professor Sathaye who did the lion's share of the editing of these proceedings.

Abhyankar's contributions to mathematics are legendary. It would be inappropriate for any of us to try and capture the wealth of his work or the impact that his contributions have had, in a few pages. The mere fact that this conference is the "second" birthday conference held in honor of Abhyankar is grand testimony to his mathematical ingenuity. Recall, in 1990 Purdue University celebrated Abhyankar's sixtieth birthday with a conference on Algebra, Geometry and its Applications. Since the sixtieth birthday conference, two major conjectures of Abhyankar have been proved. The first one, on Galois theory in characteristic  $p$ , was solved by Raynaud and Harbater in two independent works in 1993-94. This 1957 Abhyankar conjecture, describes what groups can and should occur as Galois groups of unramified covers of affine curves over an algebraically closed field of characteristic  $p > 0$ . For their proofs of this conjecture, Raynaud and Harbater were awarded the Frank Nelson Cole Prize in Algebra. The second conjecture relates to birational maps between algebraic varieties. In brief, Abhyankar conjectured that

any birational domination map between a pair of regular local rings in any dimension, is strongly dominated by a third regular local ring via a sequence of blow-ups with each element of the pair even if the map between the original pair of rings is not a sequence of blow-ups. Overall, Abhyankar conjectured that blow-ups are the “building blocks” of maps between varieties. The characteristic zero version of this conjecture (in all dimensions) was proved by Cutkosky in a sequence of papers in 1996-99. Notably, both conjectures were made by Abhyankar in the context of resolution of singularities of algebraic varieties. Moreover, what he laid out then was more than just conjectures - it was a philosophy and a method of studying various objects of this field.

As a token tribute to Abhyankar, we have taken the liberty of sharing a letter written by Professor Hironaka on the occasion of Abhyankar’s Honorary Doctorate - *Docteur Honoris Causa* - awarded to him by the University of Angers in France in 1998.

### Message from Field Medalist Heisuke Hironaka

Subject: Congratulation  
 From: AS6H-HRNM@j.asahi-net.or.jp (Hironaka Heisuke)  
 Date: 6 Mar 1998 11:00:12 +0900  
 To: ram@cs.purdue.edu  
 Dear Ram:  
 Your long and powerful works deserve far more than the honorary doctorate you are receiving. Even so, I am happy to hear the good news. Your originality has been a gold mine for many other algebraic geometers, including myself.  
 Now the mined gold is receiving rays of sunlight, facets after facets.  
 Very best,  
 Hei Hironaka

In these proceedings, in addition to papers by several acclaimed mathematicians, we would like to share the pleasure of including a poem titled *Polynomials and Power Series* written by Abhyankar in 1970. Notably, this poem captures the heart of Abhyankar’s creations, i.e., concrete, explicit methods. This poem was originally published in the Mathematical Intelligencer in 1972, and we are grateful to Springer to allow us to re-publish this in these proceedings. Moreover, with a view towards easy access, we have included a complete list of Abhyankar’s publications up to this point in this preface.

Finally we would like to sincerely thank all the participants, speakers, and authors for all their efforts and timely submissions, thereby making the conference a success and the publication of these proceedings possible. Special thanks also go to the staff at Springer for their patience and timely help. Comments and questions on these proceedings are welcomed and may be sent by electronic mail to either of us.

### List of Publications for Shreeram S. Abhyankar

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### Additional Lecture Notes

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Algebra, Arithmetic and Geometry with Applications  
Papers from Shreeram S. Abhyankar's 70th Birthday  
Conference

Christensen, C.; Sundaram, G.; Sathaye, A.; Bajaj, C.  
(Eds.)

2004, XVI, 785 p., Softcover

ISBN: 978-3-540-00475-2