Book Review

Interferometry and Synthesis in Radio Astronomy by **A. Richard Thompson, James M. Moran and George W. Swenson Jr.** (Springer International Publishing, 2017)

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The first edition of “Interferometry and Synthesis in Radio Astronomy” which appeared in 1986 immediately established the book as a classic reference text in the field. The preface to the first edition explains that the book did not stem from any course of lectures, “although the material included should be suitable for a graduate level course”. The preface also clarifies that the book “is intended primarily for graduate students and professionals in astronomy, electrical engineering, physics, [...]”. It is also written with radio systems engineers in mind [...]”. Interestingly, these prefatory remarks bring out both the strengths and weaknesses of the book. The book’s main strength is as a reference text — it constitutes by far the most comprehensive survey of the field; for almost all topics relevant to interferometry and aperture synthesis, this book provides at the very least the big picture view of the issues involved, as well as providing the required references for someone who needs to get into more detail. More often, the material in the book is sufficient to get one on one’s way. On the other hand, both because of the vast array of topics covered, as well as because the book is aimed at a such a diverse audience, it is not an easy book to read and does not really work as a pedagogical text. This is something that is explicitly acknowledged in the current edition, where in the preface, readers who are new to the field are strongly encouraged to first study the basic principles from some other sources. However, in my experience (and an informal, highly statistically unreliable, poll of my colleagues finds it to be their experience too), the approach in this book is sometimes askance to that in the commonly used pedagogical texts. This means that even for those who

have followed the advice of starting with some other pedagogical text, it is at times necessary to first adjust oneself to a slightly different way of looking at the problem before one is able to fully appreciate the points that the text is making.

But having said that, it is worth re-emphasizing that this book is without doubt the definitive reference text for radio astronomers, and the go to resource when one is grappling with something a little out of the ordinary way. I have very rarely referred to it while teaching graduate courses, but whenever any real life issue with the telescope comes up, it is invariably my first (and often last) port of call. And I suspect that this would in general be the case. For all these reasons, the publication of the third edition of this book is an extremely welcome development. A further, highly welcome development is that the full text is now available under open access, creative commons, non-commercial license. The radio astronomy community owes a great debt of gratitude to both the authors, as well as the funding agencies (the D. H. Menzel fund at Harvard University, as well as the US National Radio Astronomy Observatory) whose grants enabled this.

The third edition has been significantly updated, with more text added to almost every chapter. The amount of material added can be crudely judged by the increase in the size of the book; the current edition has 872 pages compared to 534 pages for the second edition. Using another gross metric, a quick set of measurements made in our dispatch section shows that the third edition weighs 1472 g, compared to 1138 g for the second edition. (For the curious, the first edition, along with its

dust jacket, came in at around 1000 g). The new material largely reflects recent developments, including a presentation of the “measurement equation” formalism (that underlies for example data reduction packages like CASA, as well as most modern polarization calibration algorithms), expanded coverage of FX correlators, polyphase filters, and an expanded discussion of model fitting in the (u,v) plane in the context of VLBI, as well as a presentation of the newer imaging algorithms, such as W-projection and A-projection. The discussion of propagation effects in the atmosphere and ionosphere has been greatly expanded and is now split into two separate chapters. The chapter on Imaging Techniques includes discussion of experimental deconvolution algorithms such as compressed sensing. There is also some new pedagogical material such as a derivation of the radiometer equation from basic principles, an overview of Fourier Transform

theory as well as of the Discrete Fourier Transform. This would make the book more self-contained, although, as mentioned above, the main strength of this book is probably as a reference text and not as a pedagogical text.

Overall, this is a significantly revised edition — and given the rapid progress in this field over the last 15 years, it is also a much needed revision. The authors have clearly put in very significant effort in updating the material, effort which will certainly ensure that this book retains its status as the standard reference in this field for the next several years.

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