

Preface

Dear Friends,

The idea and the inspiration behind writing this book did not come as one single “Eureka” moment. It got brewed within us for long. During many years of interaction with design managers and engineers at various IC design houses, we realized the importance and criticality of the role played by a good RTL designer in reducing the number of iterations from later stages to the RTL stage in the design cycle which helps the design to reach the market in time.

Specialized topics, such as DFT, Timing, Area, Power etc. have their own experts and are considered to come into play – much after RTL. However, the quality of RTL has a significant impact on these requirements. The domain experts of these specialized topics cannot be present at all times to guide the RTL designers. Many times, if an RTL designer is aware of what will cause trouble to these specialized stages later in the flow, he can at least consult with the specific domain experts, and, together they can judge on what would be best to do at the RTL stage itself. But, how can we make an RTL designer aware of these specialized topics? Imparting knowledge to RTL designer is the only way out. So, we hope this book will explain the fundamental concepts of all these specialized topics which an RTL designer should know – on the various impacts that his RTL has – on later stages of the design cycle. The book does not attempt to replace the domain experts. It tries to complement them – so that they can focus on the more complex things, while, explaining relatively simpler things is done by this book.

As part of our job at Atrenta, we have been receiving and studying RTL coding guidelines from many IC design houses. A lot of those rules needed us to analyze and think through as to what might be the main motivation behind the specific guideline. Sometimes, after the rules were coded into our software, and were in use at the design houses, we would get queries from the users as to why a specific guideline was important, or, what was the implication if they did not follow that guideline. Sometimes, it would be accompanied by: “We are aware of this RTL coding guideline that we are violating, and, we understand why this guideline is important. But, we have taken this alternative precaution. Do you still think, there is a trouble with our code?”

As we used to debate and discuss these queries within our company, and, many times with the users at the design houses, we started realizing that our users did

not only expect us to just automate the rule checking but also they were looking at us – to actually define good coding practices. Though, most large design houses have a set of good design practices; such guidelines are missing at smaller design houses. And, even at places, where the designers have access to such coding guidelines, many times the reasoning and implications are understood by the more experienced designers, while, the relatively inexperienced designers are simply expected to follow them. These designers also want to understand the reasoning behind those specific guidelines.

An RTL designer should be able to appreciate that the guidelines are not to prevent him from expressing his creativity; rather the guidelines are to prevent his RTL design from running into trouble at a later stage. The above thought process was getting inspired by another important fact of ASIC design process. ASIC design is not about putting in a bunch of bright and smart engineers on a project and letting them do the design. Rather, ASIC design has a huge element of being able to foresee the downstream impact of their specific code. It is less to do with smartness and intelligence; and more to do with “knowing”. Obviously, “knowing” would come with experience. And, it can also come with reading from other people’s experience. This is what this book is trying to do.

Hopefully, this book will find its place in the hearts and minds of anybody who generates RTL code. This includes RTL designers as well as those writing tools that generate RTL. Relatively new RTL designers will find this book to be an interesting, rich and useful collection of knowledge at one place. Experienced RTL designers will be able to appreciate and cement some already known concepts. Domain experts can enjoy the reduction in routine queries and concentrate on more complex matters in this domain. We expect their continued guidance in terms of improving the material further – for future.

Acknowledgments

Though, the book lists two of us as authors, there are many people who have contributed majorly towards the creation of this book.

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A lot of the contents of the book has evolved based on lots of discussions with our colleagues (at Atrenta), and, many designers at our customers, and, so, we would like to thank them too. Charu Puri spent a lot of her time – in helping us with the graphics.

A special mention goes to Ken Mason (of Atrenta) – who during one breakfast casually mentioned to us, “Why don’t you write a book – based on your knowledge on RTL design?” That was our first inspiration. It took several years after that.

And, at one place, when we were pretty much stuck, Prof. Manish Sharma (of IIT Delhi) gave us the push – which got us over the hump.

And, last but the most important one, we would remain indebted to our families. This being our first experience in authoring a book we had been spending much less time with our families. But, instead of complaining they kept motivating us. And, our kids – Arjun and Radhika Garg; Ruchi and Lubha Churiwala were equally excited at this venture of ours. Their follow up on our progress was more regular than the publishers☺ And, that did keep us going.

Happy Reading!

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