



## Reminiscences of my years at the University of Michigan Radiation Laboratory

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The author had the pleasure of working with Prof. T.B.A. Senior—his supervisor for both a Master’s and a PhD degree—while he was a graduate student at the University of Michigan’s Radiation Laboratory from 1993 to 2001. Initial research efforts, both analytical and numerical in nature, focused on domain terminations such as impedance boundary conditions, absorbing boundary conditions as well as perfectly matched layers. Eventually, a few years down the line, the main research effort would be the rather difficult problem of solving a class of second-order functional difference equations that arise in electromagnetic diffraction problems. The solutions sought had to satisfy very specific analytical requirements and unearthing them would require a good deal of analysis.

The approach followed was to derive associated first-order equations and to solve these equations by construction while satisfying all prescribed analytical requirements. The conceptually simple technique, which relies on the bilinear relations of Riemann [1], is however not easy to implement. Part of the difficulties arise from the need to numerically evaluate cyclic periods (branch cut contributions) in the complex plane and to correctly invert elliptic integrals by means of elliptic functions. Despite this, it can nevertheless be shown that in the limit the constructed solutions properly recover known solutions expressed in terms of Maliuzhinets functions.

The author will provide an overview of his work with Prof. Senior including a high-level discussion of the technique mentioned above. Some anecdotes will be included to paint a picture of the author’s relationship with his mentor Prof. Senior.

## References

- [1] S.R. Legault and T.B.A Senior, “Solution of a class of second-order difference equations using the bilinear relations of Riemann,” *J. Math. Phys.*, **43**, 3, March 2002, pp. 1612–1617.