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Rational functions are popular approximants, used for example in numerical methods, due to their ability to capture the behaviour of functions with poles. The most fundamental rational approximant would be the Padé Approximant, named after its inventor Henri Padé. However, for Padé Approximants, problems may occur with the behaviour of their poles. In an ideal situation, the poles of Padé Approximants converge to the poles of the function we are approximating, as we increase the degree of the approximant. In less ideal situations, the poles of the approximants behave in an unpredictable manner, destroying the approximating properties of the approximant.

One way to circumvent this problem is to construct other types of rational approximants where the poles are prescribed. Examples of such constructions are Padé Type Approximants or, more generally, Multipoint Padé Type Approximants. These are rational functions with prescribed poles, interpolating the target function at some determined set of points.

The theory of rational interpolation with prescribed poles dates back to Walsh who pioneered this field in the early twentieth century. Since the construction of such rational approximants, require us to choose the poles and interpolation points, a fundamental question is how these should be chosen in order to guarantee good approximation properties. Walsh answered some questions regarding this, but it was not until the end of the last century that further significant progress was made. As a contribution to this, I use tools from potential theory to answer questions regarding the convergence properties of these approximants.

Selected Publications:

Anders Gustafsson, Rational and Polynomial Interpolation of Analytic Functions with Restricted Growth}, Journal of Approximation Theory 112 pp. 61-72 (2001)

Stephen J. Gardiner and Anders Gustafsson, Smooth Potentials with Prescribed Boundary Behaviour, Publicacions Matematiques, 48(1) pp. 241-249 (2004)

Stephen J. Gardiner and Anders Gustafsson, Pointwise convergence and radial limits of harmonic functions. Israel Journal of Mathematics, 145(1) pp. 243-256 (2005)

Anders Gustafsson, Convergence of Rational Interpolants to Analytic Functions with Restricted Growth, Computational Methods and Function Theory, 6(1) pp. 203-222 (2006)