On Hermite-Padé approximation, Apéry's theorem, and the construction of infinitely many rational approximants to $\zeta(3)$.

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Abstract

First, a brief introduction along with a historical background will be presented. Then, a second order holonomic difference equation is derived from a simultaneous rational approximation problem. Some orthogonal forms involved in this approximation problem are used to compute the Casorati determinants for its linearly independent solutions. These solutions constitute the numerator and denominator sequences of rational approximants to $\zeta(3)$. A correspondence from the set of parameters involved in the holonomic difference equation to the set of holonomic bi-sequences formed by these numerators and denominators appears. Infinitely many rational approximants can be generated.