Barycentric Hermite interpolation and its application to data-driven model reduction

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The barycentric representation of rational interpolants offers some advantages over other classical rational formulations, one of which being the numerical stability of the barycentric formula. Here, we concentrate on the Hermite interpolation problem, for which not only measurements of the underlying function are available, but also of the function's derivatives. We revisit two model reduction algorithms based on rational approximation, i.e., the Loewner framework (Mayo/Antoulas '07) and IRKA/TF-IRKA (Gugercin/Antoulas /Beattie '08, Beattie/Gugercin '12); we show how Hermitian interpolation is connected to these methods. Moreover, we present an extension of the recent AAA algorithm (Nakatsukasa/Sete/Trefethen '18) that is adapted to satisfy Hermitian conditions (interpolating not only functions values, as the original AAA, but also values of derivatives). The new variant also uses least-squares fitting on the data set to construct a rational interpolant in barycentric representation.