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On the ideals of general binary orbits

We will identify a complex binary form $\sum_{i=0}^{d} a_i x_1^{d-i} x_2^i$ with the point $[a_0, \ldots, a_d]$ in the projective space $\mathbf{P}^d$. The latter admits an action of the special linear group $\mathrm{SL}(2, \mathbf{C})$ via a change of variables. Now let $\Omega_A \subseteq \mathbf{P}^d$ denote the Zariski closure of the orbit of a *general* binary form A. One should like to find the equivariant minimal generators of the defining ideal of the variety Ω_A.

I will present a computational answer to this question for $d \leq 10$. The calculation reveals a curious phenomenon, namely the possible existence of what may be called 'invisible' generators in the ideal. This imposes a dichotomy on the set of integers d, dividing them into 'prosaic' and 'erratic'. Hitherto, only the cases $d = 7, 10$ are known to be erratic, but it is anyone's guess how many remain to be discovered.