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*Beyond the  $g$ -theorem*

The  $g$ -theorem is a momentous result in combinatorial commutative algebra that characterizes the  $f$ -vector of a simplicial polytope  $\Delta$ . In all its known proofs, a suitable graded algebra  $R$  is considered, whose Hilbert function encodes the  $h$ -vector of  $\Delta$ , and the difficult part is to show that  $R$  admits a Lefschetz decomposition. More recently, there has been much interest in the  $g$ -conjecture, which asserts that the  $g$ -theorem can be extended to all simplicial homology spheres. In this talk, we introduce the “stress algebra”, an Artinian Gorenstein graded algebra with geometric significance that can be associated to any simplicial homology sphere, and we explain its relevance to the  $g$ -conjecture. This is joint work with Tiong Seng Tay.