Control-Volume Distributed Multi-Point Flux Approximation (CVD-MPFA): Recent Developments, including Unstructured Grids and Fracture Models

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ABSTRACT

Flux-continuous finite-volume schemes are presented for flow in porous media. The schemes have control-volume distributed (CVD) flow variables and rock properties, as in standard reservoir simulation. The schemes are designed to be consistent and flux-continuous and are comprised of families of multipoint flux approximations (CVD-MPFA). Cell-centred and cell-vertex approximations are presented. The CVD-MPFA schemes embody a natural generalisation of the standard reservoir simulation 2-point flux scheme, providing consistent flux approximations that extend to media with general tensors on structured and unstructured grids, and are gaining popularity in reservoir simulation

An overview of the CVD-MPFA finite-volume schemes is given for unstructured grids in two and three dimensions, which includes earlier triangle pressure support (TPS) and more recent full pressure support (FPS) schemes. Properties of the methods are presented. The FPS schemes prove to be robust for strongly anisotropic and heterogeneous full-tensor permeability fields, in contrast to earlier TPS schemes. The schemes are applied to problems including fractured anisotropic media. Development of surface CVD-MPFA approximation and specific fracture model approximations are discussed. Comparisons of model performance and scheme approximation and performance are presented.

Cell-vertex approximation proves to be advantageous compared to cell-centred approximation, but requires appropriate grid types for Darcy-flux approximation, and aspects of associated grid generation issues are discussed. The methods are applied to problems involving strong full-tensor permeability fields, faults and layers. The talk will touch on a number of topics including convective (depending on time) in addition to elliptic flux approximation.

REFERENCES

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