Geoscience discovery precipitated by the Analytic Element Method

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Geoscience education of porous media flow is grounded in seminal analytic solutions such as the Thiem and Theis solutions for wells with steady and transient pumping rates. Recent developments have advanced such solutions to much broader fields of study and applications using the Analytic Element Method (AEM). Solutions are presented for problems in groundwater flow, vadose zone flow, and the propagation of waves. These results illustrate their capacity to achieve nearly exact solutions (typically boundary conditions are satisfied to within 8-12 significant digits) for complicated flows occurring in neighborhoods with hundreds or more closely placed, interacting elements. Such solutions provide valuable insight into how an environment shapes its flow and wave patterns, and provides tools for scientific discovery.