

ON THE USE OF RECIPROCITY AND RECIPROCITY GAP PRINCIPLE FOR SOLVING SOME INVERSE PROBLEMS IN HYDROGEOLOGY

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Summary. We introduce a new algebraic process based on the reciprocity and reciprocity gap principle for flow problems in hydrogeology and illustrate its interest in identification problems.

The reciprocity principle, also known as the Maxwell-Betti theorem, is initially introduced in mechanics for linear problem. It establishes strong relationships between different sets of forces and the consequent displacements applied to a given structure. When the structure is altered, the reciprocity breaks down but the gap within the reciprocity becomes highly informative about the alteration of the structure and can be used inversely to identify the solid alteration.

An analogy can be established with the reciprocity principle of mechanics by using sources and boundary conditions as forcing terms and the resulting head field as a consequence. It is no longer the work of the forces that is conserved but the viscous dissipation energy.

We argue in this work that the reciprocity and the reciprocity gap principles and their concealed identification possibilities are of interest for groundwater flows. We illustrate their interest in parameter identification, like transmissivities, storage coefficients and wells' fluxes, and also in geometry recovering like internal interfaces.

Reference

S. Andrieux and A. Ben Abda. The reciprocity gap: a general concept for laws identification. Mechanics Research Communication Vol. 20, 5 (1993)

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