

FOUR-PHASE CHECKERBOARD COMPOSITES*

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Abstract. Two-dimensional periodic rectangular checkerboard media are considered in the situation where mean fluxes are prescribed across the structure. The closed-form solution is obtained in the general case where the checkerboard is constructed using four rectangular cells, each having a different, constant resistivity; this four cell structure then repeats doubly periodically to cover the whole plane. This general solution is then used to calculate the effective properties. Thus this four-phase checkerboard encapsulates many limiting and special cases; as a starting point we develop a concise closed-form solution to a basic problem involving four joined quarter planes each of a different resistivity. Subsequent manipulations yield solutions to problems posed in increasingly convoluted domains while retaining the essentially simple structure found for joined quarter planes.