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Outer preserving linear operators

A natural question about linear operators on Hardy space is answered, motivated by work in geophysical imaging. We exam the question of what bounded linear operators on Hardy space preserve the set of all shifted outer functions. This semigroup of operators is of interest in studies of geophysical imaging because of their utility in modeling certain physical processes. A complete characterization is determined, which allows an explicit construction of all such operators. Every operator that preserves the set of shifted outer functions is necessarily a product-composition operator, consisting of composition with a shifted outer function followed by multiplication with a (possibly different) shifted outer function.

Some applications to seismic imaging will be discussed, concerning the modeling of propagation of seismic wave energy through the earth.