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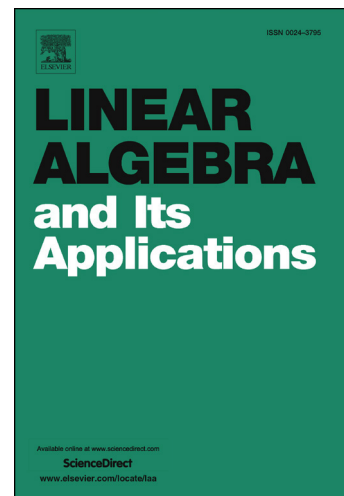
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On some factorizations of operators

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Abstract

Given two subsets \mathcal{A} and \mathcal{B} of the algebra of bounded linear operators on a Hilbert space \mathcal{H} we denote by $\mathcal{AB} := \{AB : A \in \mathcal{A}, B \in \mathcal{B}\}$. The goal of this article is to describe \mathcal{AB} if \mathcal{A} and \mathcal{B} denote classes of projections, partial isometries, positive (semidefinite) operators, etc. Moreover, fixed $T \in \mathcal{AB}$ we shall describe $(\mathcal{AB})_T := \{(A, B) \in \mathcal{A} \times \mathcal{B} : AB = T\}$, $p_1((\mathcal{AB})_T) := \{A \in \mathcal{A} : T = AB \text{ for some } B \in \mathcal{B}\}$ and $p_2((\mathcal{AB})_T) := \{B \in \mathcal{B} : T = AB \text{ for some } A \in \mathcal{A}\}$.

Keywords: Factorizations, polar decomposition, projections, partial isometries
2010 MSC: 47A05

1. Introduction

Let \mathcal{H} be a Hilbert space and denote by \mathcal{L} the algebra of bounded linear operators on \mathcal{H} . The main goal of this paper is the characterization of

$$\mathcal{AB} = \{AB : A \in \mathcal{A}, B \in \mathcal{B}\}, \quad (1)$$

for certain subsets \mathcal{A} and \mathcal{B} of \mathcal{L} . Moreover, for $T \in \mathcal{AB}$ we study the set:

$$(\mathcal{AB})_T := \{(A, B) \in \mathcal{A} \times \mathcal{B} : AB = T\},$$

and its natural projections

$$p_1((\mathcal{AB})_T) := \{A \in \mathcal{A} : T = AB \text{ for some } B \in \mathcal{B}\},$$

and

$$p_2((\mathcal{AB})_T) := \{B \in \mathcal{B} : T = AB \text{ for some } A \in \mathcal{A}\}.$$

Of course, it looks impossible to find methods which allow to deal with the problem for general \mathcal{A} and \mathcal{B} . We shall show that in many concrete natural cases, the problem is not

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