Extension Theory of Sectorial Linear Relations. A Factorization Approach

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The Kreĭn-von Neumann and the Friedrichs extensions of a sectorial relation are characterized in terms of factorizations. For this purpose, the one-to-one correspondence between densely defined closed sectorial forms and maximal sectorial operators is extended to the case of nondensely defined closed sectorial forms and maximal sectorial linear relations, respectively. As in the case of nonnegative linear relations, these factorizations lead to a novel approach to the transversality and equality of the Kreĭn-von Neumann and the Friedrichs extensions and to the notion of positive closability (the Kreĭn-von Neumann extension being an operator). Furthermore, all extremal extensions of the linear relation are characterized in terms of analogous factorizations. This approach for the general case of sectorial linear relations in a Hilbert space extends the applicability of such factorizations. In particular, all maximal sectorial extremal extensions of a bounded sectorial linear operator are characterized.