

19 Jun
12:25

Generalized upper and lower Legendre conjugates for weight functions

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We introduce and study new transformations between two (weight) functions satisfying some basic growth properties and generalize the known upper and lower Legendre conjugate (or envelope). We work within a general setting which allows for applications for weighted spaces in different directions and abstractly we also investigate how these transformations modify recently defined growth indices for weight functions. It turns out that the study of the upper conjugate is more delicate since this operation is not yielding a weight function in general.

Two concrete situations are then treated in more detail. On the one hand, we focus on associated weight functions which are expressed in terms of an underlying weight sequence. In this case the generalized lower conjugate precisely corresponds to taking the point-wise product of the given sequences and the upper conjugate corresponds to the point-wise division. This fact is of particular interest in the weight sequence settings. On the other hand, we apply the knowledge to abstractly given weight functions in the sense of Braun-Meise-Taylor and study the effects of these operations on the corresponding associated weight matrices. In this setting we provide an immediate application and generalize a very recent result concerning the continuity and the range of the resolvent operator when being considered on weighted spaces of globally defined functions of Gelfand-Shilov type.
