Some results about a filtration of starlike functions

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Let $\mathcal{A}$ be the class of functions f that are analytic in the open unit disk Δ and are normalized such that $f(0) = f'(0) - 1 = 0$. Also, let $\mathcal{S}^*$ be the class of normalized starlike univalent functions

$$\mathcal{S}^* = \left\{ f \in \mathcal{A} : \operatorname{Re}\left[\frac{zf'(z)}{f(z)}\right] > 0,\ z \in \Delta \right\}.$$

Now, using the operator

$$D[f](t,z) = t|z|^2 \frac{f(z)}{zf'(z)} + (1-t)\left[1 - \frac{f(z)f''(z)}{[f'(z)]^2}\right](1-|z|^2)$$

(t is real and $z \in \Delta$) we define class $\mathcal{S}_t^*$, $t \in [0,1]$, consisting of functions $f \in \mathcal{A}$ such that

$$\operatorname{Re} D[f](t,z) \geq 0, \quad z \in \Delta.$$

It turns out that the family of classes $\mathcal{S}_t^*$, $t \in [0,1]$, is a filtration of the class of starlike functions. In addition, for a function f from $\mathcal{S}_t^*$ we give a result over the real part of $\frac{f(z)}{zf'(z)}$ and an approximation property of f.