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On local irreducibility of the spectrum

Let $\mathcal{M}_n$ be the algebra of $n \times n$ complex matrices, and for $x \in \mathcal{M}_n$ denote by $\sigma(x)$ and $\rho(x)$ the spectrum and spectral radius of x respectively. Let D be a domain in $\mathcal{M}_n$ containing 0, and let $F \colon D \to \mathcal{M}_n$ be a holomorphic map. We prove:

(1) if $\sigma\big(F(x)\big) \cap \sigma(x) \neq \emptyset$ for $x \in D$, then $\sigma\big(F(x)\big) = \sigma(x)$ for $x \in D$;

(2) if $\rho\big(F(x)\big) = \rho(x)$ for $x \in D$, there exists λ of modulus one such that $\sigma\big(F(x)\big) = \lambda\sigma(x)$ for $x \in D$.

Both results are special cases of theorems expressing the irreducibility of the spectrum $\sigma(x)$ near $x = 0$.

Joint work with T. J. Ransford.