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Varieties of invariant subspaces given by Littlewood–Richardson tableaux

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Given partitions α, β, γ, the short exact sequences

$$0 \to N_\alpha \to N_\beta \to N_\gamma \to 0$$

of nilpotent linear operators of Jordan types α, β, γ, respectively, define a constructible subset $\mathbb{V}^{\beta}_{\alpha,\gamma}$ of an affine variety.

Geometrically, the varieties $\mathbb{V}^{\beta}_{\alpha,\gamma}$ are of particular interest as they occur naturally and since they typically consist of several irreducible components. In fact, each Littlewood–Richardson tableaux Γ of shape (α, β, γ) contributes one irreducible component $\overline{\mathbb{V}}_\Gamma$.

We consider the partial order $\Gamma \leq^*_{\text{bound}} \tilde{\Gamma}$ on LR-tableaux which is the transitive closure of the relation given by $\mathbb{V}_{\tilde{\Gamma}} \cap \overline{\mathbb{V}}_\Gamma \neq \varnothing$. In this paper we compare the boundary-relation with partial orders given by algebraic, combinatorial and geometric conditions. In the case where the parts of α are at most two, all those partial orders are equivalent. We prove that those partial orders are also equivalent in the case where $\beta \backslash \gamma$ is a horizontal and vertical strip. Moreover, we discuss how the orders differ in general.

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