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PROMOTION AND GROWTH DIAGRAMS FOR FANS OF DYCK PATHS AND VACILLATING TABLEAUX

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We construct an injection from the set of r-fans of Dyck paths (resp. vacillating tableaux) of length n into the set of chord diagrams on $[n]$ that intertwines promotion and rotation. This is done in two different ways, namely as fillings of promotion–evacuation diagrams and in terms of Fomin growth diagrams. Our analysis uses the fact that r-fans of Dyck paths and vacillating tableaux can be viewed as highest weight elements of weight zero in crystals of type B_r and C_r, respectively, which in turn can be analyzed using virtual crystals. On the level of Fomin growth diagrams, the virtualization process corresponds to the Roby–Krattenthaler blow-up construction. One of the motivations for finding rotation-invariant diagrammatic bases such as chord diagrams is the cyclic sieving phenomenon. Indeed, we give a cyclic sieving phenomenon on r-fans of Dyck paths and vacillating tableaux using the promotion action.

This is based on joint work with Joseph Pappe, Stephan Pfannerer, and Mary Claire Simone (see `https://arxiv.org/abs/2212.13588`).