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Root Vectors, PBW and Canonical Bases of Ringel–Hall Algebras and Quantum Groups

Let $\mathbf{g} = \mathbf{g}(C)$ be the Kac–Moody Lie algebra associated to a Cartan matrix C and $\mathbf{U} = \mathbf{U}_v(\mathbf{g})$ its quantum group. A key feature in quantum groups is the presence of several natural bases (like the PBW-basis and the canonical basis). There are different approaches to the construction of the canonical basis: algebraic approach (Lusztig, Kashiwara, Beck–Chari–Pressley, Beck–Nakajima), geometric approach (Lusztig) and Ringel–Hall algebra approach (Ringel, Lin–Xiao–Zhang). In this talk, we will recall algebraic and Ringel–Hall algebra approaches to a PBW basis and a canonical basis of $\mathbf{U}$ when C is finite or affine. Meanwhile, the root vectors in Ringel–Hall algebras will be discussed.