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On the composition of irreducible morphisms

Let A be an artin algebra. Using the so-called Auslander–Reiten theory, one can assign to A a quiver Γ_A called the *Auslander–Reiten quiver of* A which "represents" the indecomposable finitely generated A-modules together with some morphisms between them called irreducible. Unfortunately, Γ_A does not give all the informations on the category $\mathrm{mod}\, A$ of the finitely generated A-modules one could expect because not all morphisms can be re-constructed from the irreducible ones. However, (sum of) compositions of irreducible morphisms can give important informations on $\mathrm{mod}\, A$.

A morphism $f\colon X \to Y$ is called *irreducible* provided it does not split and whenever $f = gh$, then either h is a split monomorphism or g is a split epimorphism. It is not difficult to see that such an irreducible morphism f belongs to the radical $\mathrm{rad}(X, Y)$ but not to its square $\mathrm{rad}^2(X, Y)$. Consider now a non-zero composition $g = f_n \cdots f_1\colon X_0 \to X_n$ of $n \geq 2$ irreducible morphisms $f_i' s$. It is not always true that $g \in \mathrm{rad}^n(X_0, X_n) \setminus \mathrm{rad}^{n+1}(X_0, X_n)$. In this talk, we shall discuss some results on the problem of when such a composition does lie in $\mathrm{rad}^n(X_0, X_n) \setminus \mathrm{rad}^{n+1}(X_0, X_n)$. The particular cases $n = 2, 3$ will be considered in more details.

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