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From Bipartite Graphs to Local Structure of Certain Free Objects

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We begin by introducing a very natural way of constructing a completely 0-simple semigroup from any connected bipartite graph. The resulting object is idempotent generated and objects of this form can be used to describe the idempotent generated subsemigroup of regular principal factors in the free objects in certain varieties of semigroups \mathbf{RS}_n or in the free profinite semigroup $\overline{\Omega}_n(\mathcal{RS})$. Here \mathbf{RS}_n denotes the variety generated by the class of completely 0-simple semigroups over groups of exponent dividing n and \mathcal{RS} denotes the pseudovariety generated by finite completely 0-simple semigroups. It will be shown how, by incorporating labelled edges, it is possible to go a step further and obtain an object that will describe the full regular principal factors, in the case of \mathbf{RS}_n , and a dense subset of the full regular principal factors in the case of $\overline{\Omega}_n(\mathcal{RS})$.