

# Hopf algebras and the Penrose polynomial

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Let  $\lambda$  be a positive integer and let  $G$  be a plane graph. Let  $P(G, \lambda)$  be the Penrose polynomial of  $G$ . We will present an interpretation of  $P(G, -\lambda)$  in terms of colourings of  $G$ . In order to prove our main theorem we construct a Hopf algebra  $\mathcal{A}$  of graphs and a homomorphism of Hopf algebras  $\Psi$  from  $\mathcal{A}$  onto a Hopf algebra of polynomials in one indeterminate. If  $G$  is a plane graph, then  $\Psi(G)$  coincides with the Penrose polynomial of  $G$ .