Drawing an Embedded Graph in an Alternative Surface

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Let G be a graph embedded in a surface S. As Robertson and Vitray proved, if G is sufficiently densely embedded in S, then G genus embeds in S, that is, G does not embed in any surface of genus smaller than the genus of S. Therefore, every drawing of G in an alternative surface S' with smaller genus than S will necessarily have positive crossing number. A natural question arises: can we estimate the crossing number of such an embedding? We will discuss some recent research on this problem, giving lower bounds for the crossing number of G in S' in terms of typical parameters associated to the embedding of G in S.