

- ▶ ALESSANDRA CARBONE, *Proof structures and complexities*.  
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The genus of a proof is a measure of proof complexity and through it we discuss a few geometrical properties of logical flow graphs of proofs, with and without cuts, with the purpose in mind to represent how complicated a cut-free proof can be. The main result says that arbitrarily complicated non oriented graphs, that is graphs of arbitrarily large genus, can be encoded in a cut-free proof. This fact was proved by Richard Statman in his thesis written in the early seventies and never published. We reformulate Statman's result in a purely graph theoretical language and will present the intuition of the proof. We show that there are several ways to embed non oriented graphs of arbitrary complexity into cut-free proofs and provide some other direct embeddings of arbitrarily complex non oriented graphs into proofs possibly with cuts. We also show that given any formal circuit, we can codify it into a proof in such a way that the graph of the circuit corresponds to the logical flow graph of the encoding proof [2].

Time permitting, we shall describe how certain finitely presented groups are encoded in the structure of proofs with cuts. The cyclic structure that they form and the impact in proof complexity that such cycles induce will be explained [1].

[1] CARBONE A, *Asymptotic cyclic expansion and bridge groups of formal proofs*, *Journal of Algebra*, vol. 242 (2001), pp. 109–145.

[2] CARBONE A, *Logical structures and genus of proofs*, *Annals of Pure and Applied Logic*, vol. 161 (2009), no. 2, pp. 139–149.