

Abstract Submitted
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Leonardo's branching rule in trees: How self-similar structures resist wind¹ CHRISTOPHE ELOY, UC San Diego — In his notebooks, Leonardo da Vinci observed that “*all the branches of a tree at every stage of its height when put together are equal in thickness to the trunk,*” which means that the total cross-sectional area of branches is conserved across branching nodes. The usual explanation for this rule involves vascular transport of sap, but this argument is questionable because the portion of wood devoted to transport varies across species and can be as low as 5%. It is proposed here that Leonardo's rule is a consequence of the tree skeleton having a self-similar structure and the branch diameters being adjusted to resist wind-induced loads. To address this problem, a continuous model is first considered by neglecting the geometrical details of branching and wind incident angles. The robustness of this analytical model is then assessed with numerical simulations on tree skeletons generated with a simple branching rule producing self-similar structures.

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