

SiNuPrOs Fast - Description

The main idea of this Fast version is quite simple and consists in building a data base of values of mechanical properties of cortical bone at the macroscopic, osteonal and lamellar level. The using of this data base coupled with a method of the approximation theory allows the obtaining of the architectural configuration of the sample whose some mechanical properties are experimentally measured. The main advantage of the Fast version is that the obtaining of the results is immediate. Once the researched configuration has been thus obtained, it has then to be validated by the original version of the software SiNuPrOs.

Reference configuration

Firstly, a reference configuration is built and the properties for this "reference configuration" are calculated using the SiNuPrOs program. This reference configuration is obtained for the values of the parameters that give a percentage in mass of 63 % for Hap and 37 % for the collagen. Some of these values are getting from the literature and the others are introduced in the modelization of the mineral phase (percentages of EVMC and percentages of linked water respectively in the current lamella and in the interstitial system and coefficient of nanoscopic anisotropy). For them, there is no possible information in the literature or by measurements and the values have been chosen in respect with the numerical problem and a plausible physical signification. The reference configuration is not important for itself but it is necessary to organize the parametric study of our model.

Building of a database

Secondly, we study the influence of each parameter on the macroscopic (osteonal and lamellar) properties of the cortical. More precisely, by varying only one parameter, on compute the cortical properties using the SiNuPrOs program and we study the influence that it could has on these properties. All the computed properties are stoked in our data base.

Principe of SiNuPrOs Fast

With this data base one can compute, using the Excel component of Microsoft Office Suite, the polynomial approximations (of fourth order) which will give later the possible values of the parameters which could give the exact bony properties that we researched.

SiNuPrOs Fast user's guide

The data file "*Sinupros Fast.xls*" contains all the architectural parameters (concerning haversian structure, lamellar structure and mineral structure) and the Hap and collagen densities. The physical characteristics (Hap and collagen Young's moduli, Poisson's ratios, etc) are those given in the SiNuPrOs description.

The values in red are the parameters of the reference configuration; the green ones represent the permissible intervals of variation for the architectural parameters. The values in white are the values of architectural parameters which are introduced for testing different architectural configurations. The values obtained after the downloading are, by default, those characterizing the reference configuration.

One can change one parameter or several, the results can be seen immediately in the file of results "*xx Physical Properties.xls*". This file contains the elastical properties of human cortical bone at the macroscopic (osteonal and lamellar) level and also the Young's moduli, the ratio between the longitudinal and transverse elastic properties and the ratio between the longitudinal and transverse cortical Young's moduli. The correspondent percentage of Hap mass is also calculated.

ATTENTION ! All the other files (except the 2 previous ones) are used to compute the cortical bone properties. Don't change them in any way !! Moreover, any "accidental" change in these files could produce serious errors on the results.