ABSTRACT  A 3D numerical model of a degraded experimental small-scale facility, simulating an opaque rod bundle of a nuclear reactor core has been built from γ-ray tomography images. It has been directly characterized by both extinction cumulated distribution functions $G_{\text{ext}}$ and scattering phase functions $p$. $G_{\text{ext}}$ strongly differs from the exponential function associated with the Beer law and $p$ strongly depends on both the incidence and the scattering directions. By assuming a diffuse wall reflection law, we have directly determined a radiative conductivity tensor with a numerical perturbation method of the generalized radiative transfer equation, associated with the previous statistical functions and introduced by Taine et al. Only the diagonal radial and axial components of this tensor are not null. They have been fitted by a simple law, only depending on the porosity, on the specific area and on the wall absorptivity.