The non-increasing rearrangement of a measurable real function defined on an appropriate measure space is of the enormous significance in disciplines such as theory of function spaces or interpolation theory and their applications in PDEs. Unfortunately, while it has good and widely applicable mapping properties, it is virtually impossible to calculate the non-increasing rearrangement of a concrete given function precisely. Numerical algorithms for approximation are desirable for this reason. Such method of approximation, based on interpolation by a linear spline, is presented in this thesis. In the first half of this thesis, the developed method is described, while the error estimates of the method are subject to the second part.