

Wavelet Approach to Hamiltonian, Chaotic and Quantum Calculations in Accelerator Physics,

A.N. FEDOROVA, M.G. ZEITLIN, IPME, Russian Academy of Sciences; Z. PARSA, BNL - This is a second part of two talks in which we present applications of methods from wavelet analysis to nonlinear accelerator physics problems. We give the generalization of our approach from part 1 to Hamiltonian systems and their perturbations which have rich hidden structures (symplectic or Poissonian or quasicomplex) and complicated behaviour (transition from Liouvillean tori to KAM tori and then to chaotic or fractal behaviour for different regions in parameter space). We still have the general multiscale or multiresolution expansions for dynamical variables but constructions is much more complicated than in part 1 because we need to take into account underlying hidden structures in any type of calculations. For this reason according to orbit method and by using constructions from the geometric quantization theory we construct the symplectic and Poisson structures associated with generalized wavelets by using metaplectic structure. We use our approach for the problem of explicit calculations of closed loops (Arnold-Weinstein curves) via Floer variational approach. Also we consider the calculations of Melnikov functions in the theory of homoclinic chaos. Then for the quantum problems and problems related with KAM theory we consider the generalization of multiresolution representation to the case in which we need to consider symplectic Hilbert scales of spaces and representation of operators in them.