Morse homotopy and invariants of manifolds

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After Witten's discovery of path integral interpretation of quantum invariants of knots and 3-manifolds, several rigorous and powerful theories of universal invariant for homology 3-spheres appeared, e.g. perturbative Chern–Simons theory Z^{CS} of Axelrod–Singer and Kontsevich, and a combinatorial invariant Z^{LMO} of Le–Murakami–Ohtsuki. These invariants take values in a space of graphs called Jacobi diagrams or Feynman diagrams, and are known to be universal among Ohtsuki's finite type invariants for rational homology 3-spheres. Z^{CS} is defined by integration over spaces of configurations of points on a 3-manifold and hence can be considered as an "analytic" invariant. Z^{LMO} is constructed from Kontsevich's link invariant by ingenious combinatorial argument and can be considered as an "algebraic" invariant.

My talk is concerned with Fukaya's "topological" construction of invariant of 3-manifolds, obtained by using Morse theory. We give a generalization of Fukaya's invariant to graphs with arbitrary number of loops at least 2.