LIST OF PUBLICATIONS, WITH ABSTRACTS

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• The contact homology of conormal lifts of knots and links (with T. Ekholm, J. Etnyre, and M. Sullivan), in preparation.

This paper uses the gradient flow tree techniques of Fukaya–Oh to demonstrate that the combinatorial “knot contact homology” defined in the author’s papers below (“Knot and braid invariants from contact homology I, II,” “Framed knot contact homology”) does in fact analytically yield the holomorphic-curve contact homology of the relevant Legendrian tori.


Abstract: We establish an upper bound for the Thurston–Bennequin number of a Legendrian link using the Khovanov homology of the underlying topological link. This bound is sharp in particular for all alternating links, and knots with nine or fewer crossings.

• The correspondence between augmentations and rulings for Legendrian knots (with J. Sabloff), Pacific J. Math., to appear.

Abstract: We strengthen the link between holomorphic and generating-function invariants of Legendrian knots by establishing a formula relating the number of augmentations of a knot’s contact homology to the complete ruling invariant of Chekanov and Pushkar.


Abstract: We apply contact homology to obtain new results in the problem of distinguishing immersed plane curves without dangerous self-tangencies.


Abstract: We summarize recent work on a combinatorial knot invariant called knot contact homology. We also discuss the origins of this invariant in symplectic topology, via holomorphic curves and a conormal bundle naturally associated to the knot.

Abstract: We extend knot contact homology to a theory over the ring \(\mathbb{Z}[\lambda^{\pm 1}, \mu^{\pm 1}]\), with the invariant given topologically and combinatorially. The improved invariant, which is defined for framed knots in \(S^3\), can distinguish many pairs of knots, including mutants, and can also be defined for knots in arbitrary manifolds. It contains the Alexander polynomial and naturally produces a two-variable polynomial knot invariant which is related to the \(A\)-polynomial.


Abstract: Differential graded algebra invariants are constructed for Legendrian links in the 1-jet space of the circle. In parallel to the theory for \(\mathbb{R}^3\), Poincaré–Chekanov polynomials and characteristic algebras can be associated to such links. The theory is applied to distinguish various knots, as well as links that are closures of Legendrian versions of rational tangles. For a large number of two-component links, the Poincaré–Chekanov polynomials agree with the polynomials defined through the theory of generating functions. Examples are given of knots and links which differ by an even number of horizontal flypes that have the same polynomials but distinct characteristic algebras. Results obtainable from a Legendrian satellite construction are compared to results obtainable from the DGA and generating function techniques.

- **Knot and braid invariants from contact homology II**, *Geom. Topol.* **9** (2005), 1603–1637.

Abstract: We present a topological interpretation of knot and braid contact homology in degree zero, in terms of cords and skein relations. This interpretation allows us to extend the knot invariant to embedded graphs and some higher-dimensional knots. We give a related presentation for knot contact homology in terms of plats, including a calculation for all two-bridge knots.


Abstract: We introduce topological invariants of knots and braid conjugacy classes, in the form of differential graded algebras, and present an explicit combinatorial formulation for these invariants. The algebras conjecturally give the relative contact homology of certain Legendrian tori in five-dimensional contact manifolds. We present several computations and derive a relation between the knot invariant and the Alexander polynomial.


Abstract: We provide a translation between Chekanov’s combinatorial theory for invariants of Legendrian knots in the standard contact \(\mathbb{R}^3\) and a relative version of Eliashberg and Hofer’s Contact Homology. We use this translation to transport the idea of “coherent orientations” from the Contact Homology world to Chekanov’s combinatorial setting. As a result, we obtain a lifting of Chekanov’s differential graded algebra invariant to an algebra over \(\mathbb{Z}[t, t^{-1}]\) with a full \(\mathbb{Z}\) grading.

Abstract: We establish tools to facilitate the computation and application of the Chekanov-Eliashberg differential graded algebra (DGA), a Legendrian-isotopy invariant of Legendrian knots in standard contact three-space. More specifically, we reformulate the DGA in terms of front projection, and introduce the characteristic algebra, a new invariant derived from the DGA. We use our techniques to distinguish between several previously indistinguishable Legendrian knots and links.


Abstract: We compute the maximal Thurston–Bennequin number for a Legendrian two-bridge knot or oriented two-bridge link in standard contact $\mathbb{R}^3$, by showing that the upper bound given by the Kauffman polynomial is sharp. As an application, we present a table of maximal Thurston–Bennequin numbers for prime knots with nine or fewer crossings.


Summary: A connection discovered between the Heisenberg ferromagnet model and a problem in the theory of random walks allows us to verify the Bethe ansatz from physics in a special case, and to apply this case to solve the random walks problem.


• $k$-ordered hamiltonian graphs (with M. Schultz), *J. Graph Theory* **24** (1997), 45–57.