

A PROOF OF THE GREEN–OSHER INEQUALITY

YUNLONG YANG AND PINGLIANG HUANG

Abstract. In this paper we give a different proof of the Green–Osher inequality and show that equality holds if and only if γ is a circle when $F(x)$ is a strictly convex function on $(0, +\infty)$.

Mathematics subject classification (2010): 52A38, 52A40.

Keywords and phrases: Green–Osher’s inequality, Bonnesen’s inequality, minimal annulus.

REFERENCES

- [1] T. BONNESEN, *Les Problèmes des Isopérimètres et des Isépiphanes*, Paris, Gauthier-Villars, 1929.
- [2] T. BONNESEN AND W. FENCHEL, *Theory of Convex Bodies*, BCS Associates, Moscow, ID, 1987.
- [3] Y. DAI, W. X. XU AND J. ZHOU, *Some Bonnesen style inequalities and planar isoperimetric deficit upper limit*, Proceedings of The Fourteenth International Workshop on Diff. Geom., **14** (2010), 69–76.
- [4] F. EDLER, *Vervollständigung der Steinerschen elementargeometrischen Beweise für den Satz, dass der Kreis grösseren Flächeninhalt besitzt als jede andere ebene Figur gleich grossen Umfangs*, Nachr. Ges. Wiss. Göttingen, (1882), 73–80. [translated into French and printed in Bull. Sci. Math., **7** (1883), 198–204].
- [5] M. E. GAGE, *An isoperimetric inequality with applications to curve shortening*, Duke Math. J., **50** (1983), 1225–1229.
- [6] M. E. GAGE, *Curve shortening makes convex curves circular*, Invent. Math., **76** (1984), 357–364.
- [7] M. E. GAGE, *On an area-preserving evolution equation for plane curves*, in Nonlinear Problems in Geometry (D. M. DeTurck edited), Contemp. Math., **51** (1986), 51–62.
- [8] M. E. GAGE, *Positive centers and the Bonnesen inequality*, Proc. Amer. Math. Soc., **110** (1990), 1041–1048.
- [9] M. E. GAGE AND R. S. HAMILTON, *The heat equation shrinking convex plane curves*, J. Differential Geom., **23** (1986), 69–96.
- [10] M. GREEN AND S. OSHER, *Steiner polynomials, Wulff flows, and some new isoperimetric inequalities for convex plane curves*, Asian J. Math., **3** (1999), 659–676.
- [11] L. S. JIANG AND S. L. PAN, *On a non-local curve evolution problem in the plane*, Comm. Anal. Geom., **16** (2008), 1–26.
- [12] G. LAWLOR, *A new area-maximization proof for the circle*, Math. Intelligencer, **20** (1998), 29–31.
- [13] P. LAX, *A short path to the shortest path*, Amer. Math. Monthly, **102** (1995), 158–159.
- [14] H. MARTINI AND Z. MUSTAFAEV, *On isoperimetric inequalities in Minkowski space*, J. Inequal. Appl., 2010, Art. ID 697954, 18pp.
- [15] D. S. MITRINović, J. E. PEČARIĆ AND V. VOLENEC, *Recent Advances in Geometric Inequalities*, Kluwer Academic Publishers Group, Dordrecht, 1989.
- [16] K. OU AND S. L. PAN, *Some remarks about closed convex curves*, Pacific J. Math., **248** (2010), 393–401.
- [17] S. L. PAN, X. W. SUN AND Y. D. WANG, *A variant of the isoperimetric problem, Part I*, Sci. China Ser. A, **51** (2008), 1119–1126.
- [18] S. L. PAN AND J. N. YANG, *On a non-local perimeter-preserving curve evolution problem for convex plane curves*, Manuscripta Math., **127** (2008), 469–484.
- [19] C. PERI AND A. ZUCCO, *On the minimal convex annulus of a planar convex body*, Monatsh. Math., **114** (1992), 125–133.
- [20] C. PERI, J. M. WILLS AND A. ZUCCO, *On Blaschke’s extension of Bonnesen’s inequality*, Geom. Dedicata, **48** (1993), 349–357.

- [21] L. A. SANTALÓ, *Integral Geometry and Geometric Probability*, Addison-Wesley 1976.
- [22] J. STEINER, *Sur le maximum et le minimum des figures dans le plan, sur la sphère et dans l'espace en général, I and II*, J. Reine Angew. Math. (Crelle), **24** (1842), 93–152 and 189–250.
- [23] A. TREIBERGS, *The Strong isoperimetric inequality of Bonnesen*, University of Utah, 2006.
<http://www.math.utah.edu/~treiberg/isoperim/Bonn.pdf>