

## BOAS-TYPE INEQUALITIES VIA SUPERQUADRATIC FUNCTIONS

KRISTINA KRULIĆ, JOSIP PEČARIĆ AND DORA POKAZ

*Abstract.* We state and prove some new Boas type inequalities using the concept of superquadratic and subquadratic functions. We apply this result to refine the strengthened inequalities of the Hardy type.

*Mathematics subject classification (2010):* Primary 26D10, Secondary 26D15.

*Keywords and phrases:* Inequalities, Boas inequality, superquadratic function, subquadratic function, integral identities.

### REFERENCES

- [1] S. ABRAMOVICH, S. BANIĆ AND M. MATIĆ, *Superquadratic functions in several variables*, J. Math. Anal. Appl. **327**, 2 (2007), 1444–1460.
- [2] S. ABRAMOVICH, G. JAMESON AND G. SINNAMON, *Refining of Jensen's inequality*, Bull. Math. Soc. Sci. Math. Roumanie (N.S.) **47**, 95 (2004), 3–14.
- [3] S. ABRAMOVICH, G. JAMESON AND G. SINNAMON, *Inequalities for averages of convex and superquadratic functions*, J. Inequal. Pure and Appl. Math. **5**, 4 (2004), Art. 91.  
Online: <http://www.emis.de/journals/JIPAM>.
- [4] S. ABRAMOVICH, K. KRULIĆ, J. PEČARIĆ, AND L.-E. PERSSON, *Some new refined Hardy type inequalities with general kernels and measures*, Aequationes mathematicae. **79**, 1–2 (2010), 157–172.
- [5] R. P. BOAS, *Some integral inequalities related to Hardy's inequality*, J. Anal. Math. **23** (1970), 53–63.
- [6] A. ČIŽMEŠIJA, S. HUSSAIN AND J. PEČARIĆ, *Some new refinements of strengthened Hardy and Pólya-Knopp's inequalities*, J. Funct. Spaces Appl. **7**, 2 (2009), 167–186.
- [7] A. ČIŽMEŠIJA, J. PEČARIĆ, AND L.-E. PERSSON, *On strengthened Hardy and Pólya-Knopp's inequalities*, J. Approx. Theory **125** (2003), 74–84.
- [8] A. ČIŽMEŠIJA, J. PEČARIĆ, AND D. POKAZ, *A new general Boas-type inequality and related Cauchy-type means*, Math. Inequal. Appl., to appear.
- [9] G. H. HARDY, *Note on a theorem of Hilbert*, Math. Z. **6** (1920), 314–317.
- [10] G. H. HARDY, *Notes on some points in the integral calculus LX: An inequality between integrals* (60), Messenger of Math. **54** (1925), 150–156.
- [11] G. H. HARDY, *Notes on some points in the integral calculus LXIV*, Messenger of Math. **57** (1928), 12–16.
- [12] S. KAIJSER, L.-E. PERSSON, AND A. ÖBERG, *On Carleman and Knopp's Inequalities*, J. Approx. Theory **117** (2002), 140–151.
- [13] K. KRULIĆ, J. PEČARIĆ, AND L.-E. PERSSON, *Some new Hardy type inequalities with general kernels*, Math. Inequal. Appl. **12** (2009), 473–485.
- [14] A. KUFNER, L. MALIGRANDA, AND L.-E. PERSSON, *The Hardy Inequality - About its History and Some Related Results*, Vydavatelsky Servis Publishing House, Pilsen, 2007.
- [15] D. LUOR, *Modular inequalities for the Hardy-Littlewood averages*, Math. Inequal. Appl. **13**, 3 (2010), 635–642.
- [16] J. A. OGUNTUASE AND L.-E. PERSSON, *Refinement of Hardy's inequalities via superquadratic and subquadratic functions*, J. Math. Anal. Appl. **339** (2008), 1305–1312.
- [17] J. A. OGUNTUASE, L.-E. PERSSON, E. K. ESSEL AND B. A. POPOOLA, *Refined multidimensional Hardy-type inequalities via superquadracity*, Banach J. Math. Anal. **2**, 2 (2008), 129–139.

- [18] J. E. PEČARIĆ, F. PROSCHAN, AND Y. L. TONG, *Convex functions, partial orderings, and statistical applications*, Academic Press, San Diego, 1992.
- [19] J. XIAO,  *$L^p$  and BMO Bounds of Weighted Hardy-Littlewood Averages*, J. Math. Anal. Appl. **262** (2001), 660–666.