

# Publications of Aishwarya Radhakrishnan

This document lists all peer-reviewed publications of [Aishwarya Radhakrishnan](#), Chair for Algorithm Engineering, Hasso Plattner Institute, Potsdam, Germany. This listing was automatically generated on June 29, 2022. An up-to-date version is available online at [hpi.de/friedrich/docs/publist/radhakrishnan.pdf](https://hpi.de/friedrich/docs/publist/radhakrishnan.pdf).

## Conference papers

- [1] Friedrich, T., Kötzing, T., Radhakrishnan, A., Schiller, L., Schirneck, M., Tennigkeit, G., Wietheger, S., [Crossover for Cardinality Constrained Optimization](#). In: *Genetic and Evolutionary Computation Conference (GECCO)*, 2022. **Best Paper Award (Theory Track) Nomination**.

In order to understand better how and why crossover can benefit optimization, we consider pseudo-Boolean functions with an upper bound  $B$  on the number of 1s allowed in the bit string (cardinality constraint). We consider the natural translation of the OneMax test function, a linear function where  $B$  bits have a weight of  $1 + \varepsilon$  and the remaining bits have a weight of 1. The literature gives a bound of  $\Theta(n^2)$  for the (1+1) EA on this function. Part of the difficulty when optimizing this problem lies in having to improve individuals meeting the cardinality constraint by flipping both a 1 and a 0. The experimental literature proposes balanced operators, preserving the number of 1s, as a remedy. We show that a balanced mutation operator optimizes the problem in  $O(n \log n)$  if  $n - B = O(1)$ . However, if  $n - B = \Theta(n)$ , we show a bound of  $\Omega(n^2)$ , just as classic bit flip mutation. Crossover and a simple island model gives  $O(n^2 / \log n)$  (uniform crossover) and  $O(n\sqrt{n})$  (3-ary majority vote crossover). For balanced uniform crossover with Hamming distance maximization for diversity we show a bound of  $O(n \log n)$ . As an additional contribution we analyze and discuss different balanced crossover operators from the literature.