A multi-crossover and adaptive island based population algorithm for solving routing problems

JZUS-C (Comput & Electron)

Citation: Osaba, E., Onieva, E., Carballedo, R., Diaz, F., Perallos, A., Zhang, X., 2013. A multi-crossover and adaptive island based population algorithm for solving routing problems. *Journal of Zhejiang University-Science C (Computers & Electronics)*, **14**(11):815-821. [doi:10.1631/jzus.C1300184]

- The proposed method is a variant of the traditional Island Based Genetic Algorithm
- Our algorithm reverses the classical philosophy of genetic algorithms, giving priority to local improvement
- Every subpopulation has a different crossover function, which can change depending on its efficiency
- Our technique adapts its crossover probability and function to the search performance
- The presented meta-heuristic outperforms the classic Island Based GA in terms of runtime and result quality

JZUSC (Comput & Electron)

Pseudo code of our proposal

```
1.  Create the whole population
2.  Create the subpopulations
3.  Assign the crossover functions
4.     while the termination criterion is not reached do
5.         for each subpopulation do
6.             Mutation process
7.             Crossover process
8.             Survivor selection
9.             Update the crossover probability
10.        end
11.        Individual migration process
12.     end
13.  Return the best individual of the system
```

IZUSC (Comput & Electron)

Some results

- Results of our technique (MAIPA) compared with a basic Island Genetic Algorithm (IGA) applied to the Capacitated Vehicle Routing Problem

Instance	Optimum	Average		Standard deviation		Best		Time (s)		$t^{\#}$
		MAIPA	IGA	MAIPA	IGA	MAIPA	IGA	MAIPA	IGA	
En22k4	375	391.1	401.0	8.54	15.30	375	375	1.59	3.80	+
En23k3	569	599.9	656.2	31.75	23.44	571	601	2.05	3.14	+
En30k3	534	557.7	561.6	16.00	19.41	544	542	2.16	4.23	+
En33k4	835	899.5	911.0	23.30	27.18	864	888	2.85	6.52	+
En51k5	521	619.3	628.4	45.15	31.65	561	572	4.15	25.10	+
En76k7	682	799.9	814.1	37.34	31.43	752	764	8.83	64.12	+
En76k8	735	860.5	881.3	21.72	32.40	829	834	9.27	66.54	+
En76k10	830	963.0	971.0	19.88	24.54	935	945	7.89	55.10	+
En76k14	1021	1179.1	1183.1	33.15	52.70	1139	1142	9.54	41.16	*
En101k8	815	997.2	1004.5	46.92	67.43	919	924	14.14	52.43	*
En101k14	1071	1221.7	1246.7	34.49	56.19	1173	1182	12.15	114.55	+

$^{\#}$ '+' indicates MAIPA is better than IGA; '*' indicates the difference between the two algorithms is not significant (at 95% confidence level)

JZUS C (Comput. & Electron.)