

Particle Swarms in Sizing and Global Optimization

by
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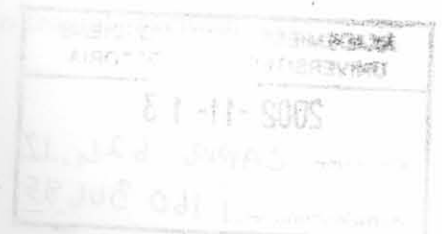
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Extensive numerical results are presented for the extended Dixon-Szegö test set, as well as a number of well known truss structures with dimensionality of up to 21. The results indicate the superiority of the gradient free PSOA for the two programming classes considered.

Abstract

Title: Particle Swarms in Sizing and Global Optimization

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In this work, the particle swarm optimization algorithm (PSOA) is implemented, evaluated and studied. A number of recently proposed variations on the PSOA are also considered. The algorithm and its variants are applied to, firstly, an extended Dixon-Szegö bound constrained global test set, and secondly, the sizing design of truss structures.

Using the extended Dixon-Szegö test set, it is shown that the constriction variant as proposed by Clerc, and the dynamic inertia and maximum velocity reduction variant proposed by Fourie and Groenwold, represent the main contenders from a cost efficiency point of view.

In the interests of finding a reliable general purpose ‘off-the-shelf’ PSOA for global optimization, a parameter sensitivity study is then performed for the constriction and dynamic inertia and maximum velocity reduction variants. In doing so, it is shown that inclusion of dynamic inertia renders the PSOA relatively insensitive to the values of the cognitive and social scaling factors.

The constriction and dynamic inertia and maximum velocity reduction variants are then applied to the optimal sizing design of truss structures. While few results with the PSOA for constrained problems have previously been presented, a simple approach is proposed herein to accommodate the stress and displacement constraints during the initial stages of the swarm searches. Increased social (peer) pressure, at the cost of cognitive learning, is exerted on infeasible birds to increase their rate of migration to feasible regions.

Extensive numerical results are presented for the extended Dixon-Szegö test set, as well as a number of well known truss structures with dimensionality of up to 21. The results indicate the suitability of the gradient free PSOA for the two programming classes considered.

Opsomming

Titel: Parabel Soek na in Alreëngewone en Globale Optimering

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In hierdie verslag word 'n eksperimentele studie van die parabelsoekna algoritme vir globale optimering, gesien vanuit die oogpunt van die toepassing van die algoritme op die parabelsoekna algoritme, word ook bespreek. Die resultate van die eksperimentele studie word ook bespreek. Die resultate van die eksperimentele studie word ook bespreek.

Met behulp van die parabelsoekna algoritme word nader ondersoek gedoen na die toepassing van die algoritme op die parabelsoekna algoritme. Die belangrikste resultate van die eksperimentele studie word ook bespreek.

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Opsomming

- Titel:** Partikel Swerms in Afmetingsontwerp en Globale Optimering
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In hierdie verhandeling word die partikel swerm optimeringsalgoritme (PSOA) geïmplementeer, ge-evalueer en bestudeer. Verskeie onlangs voorgestelde variasies op die PSOA word ook beskou. Die algoritme en die variasies daarop word dan toegepas op, eerstens, 'n uitgebreide Dixon-Szegö stel rand begrensde globale toetsprobleme, en tweedens, die afmetingsontwerp van stangstrukture.

Met behulp van die uitgebreide Dixon-Szegö toetsprobleme word aangetoon dat die inkrimping variant, voorgestel deur Clerc, en die dinamiese momentum en maksimum snelheid vermindering variant voorgestel deur Fourie en Groenwold, die belangrikste mededingers is vanuit 'n oogpunt van koste effektiwiteit.

In belang van die formulering van 'n betroubare, algemeen toepasbare PSOA vir globale optimering, word 'n parameter sensitiviteitsstudie gedoen vir die inkrimping en die dinamiese momentum en maksimum snelheid vermindering variante. Hierdie studie toon aan dat die insluiting van dinamiese momentum vermindering die PSOA onsensitief maak vir waardes van die kognitiewe en sosiale skaleringsfaktore.

Die inkrimping en dinamiese momentum en maksimum snelheid vermindering variante word dan toegepas op die probleem van optimale ontwerp van stangstrukture. Alhoewel min resultate voorheen met die PSOA vir begrensde probleme bereken is, word 'n eenvoudige benadering hierin voorgestel om spanning- en verplasingbegrensing gedurende die aanvanklike

stadiums van die swerm soektog te hanteer. Verhoogde sosiale druk (groepsdruk) word ten koste van kognitiewe leer op ontoelaatbare partikels toegepas. Hiermee word gepoog om die migrasie tempo na gunstige gebiede te bespoedig.

Omvattende numeriese resultate word voorgelê vir die uitgebreide Dixon-Szegö toetsprobleme, asook 'n paar bekende stangstrukture met dimensionaliteit van tot 21. Die resultate toon die toepaslikheid van die gradiëntlose PSOA vir die twee programmeringsklasse onder beskouing aan.

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