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A NOVEL TIKI-TAKA ALGORITHM FOR ENGINEERING OPTIMISATION

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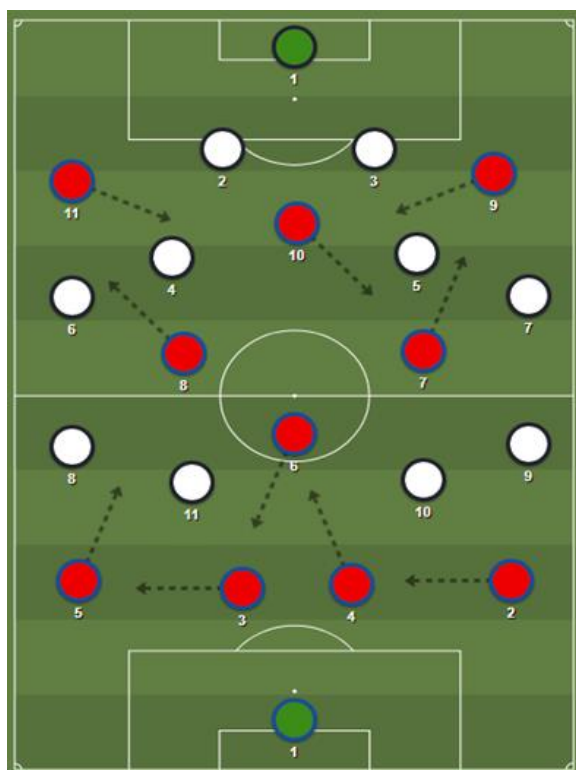EMAIL: ffaisae@ump.edu.my

Metaheuristic Algorithm Classification

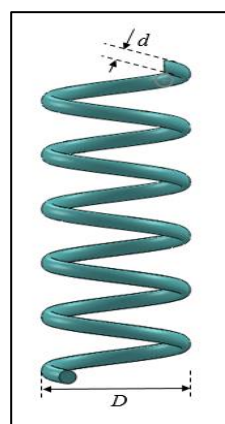| Category	Examples
Animal/insect inspired	• Whale Optimisation Algorithm • Moth Flame • Elephant Herding Algorithm
Biological inspired	• Water Wave Optimisation • Virus Colony Search • Kidney-Inspired Algorithm
Physical inspired	• Multi-Verse Optimiser • Thermal Exchange Optimisation • Atom Search Optimisation
Sport inspired	• League Championship Algorithm • Football Optimisation Algorithm • Golden Ball Algorithm

Tiki-Taka Algorithm Background

- **Metaheuristic algorithm inspired by football playing style, Tiki-Taka**
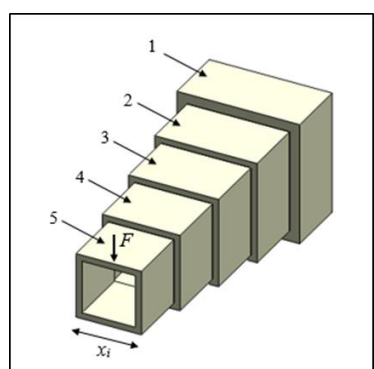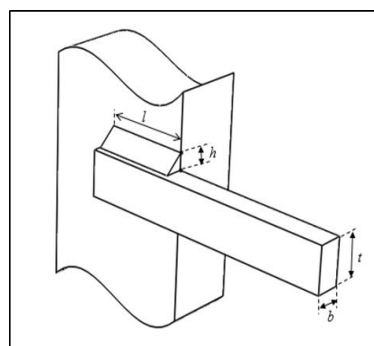

Novelty & Originality

- **Short passing: collect information from nearby solution to converge**
- **Multiple key players: maintain solution diversity & avoid premature convergence**
- **Unsuccess pass: exploration mechanism to find solution in differen region**

Application

- **Multiple dimensions optimisation**
- **Engineering problems optimisation**

Algorithm	$f(X)$
GA [47]	1.8242
CPSO [48]	1.728024
IACO [49]	1.724918
MFO [7]	1.72452
GWO [50]	1.72624
ABC [51]	1.724852
WOA [5]	1.730499
MVO [28]	1.72645
SFO [53]	1.73231
TTA	**1.695247**

Algorithm	$f(X)$
MFO [7]	1.339988
MVO [28]	1.339959
ALO [6]	1.33995
FPA [60]	1.33997
LAPO [61]	1.336521415
CSA [57]	1.33999
SMO [62]	1.31095
TTA	**1.30326**

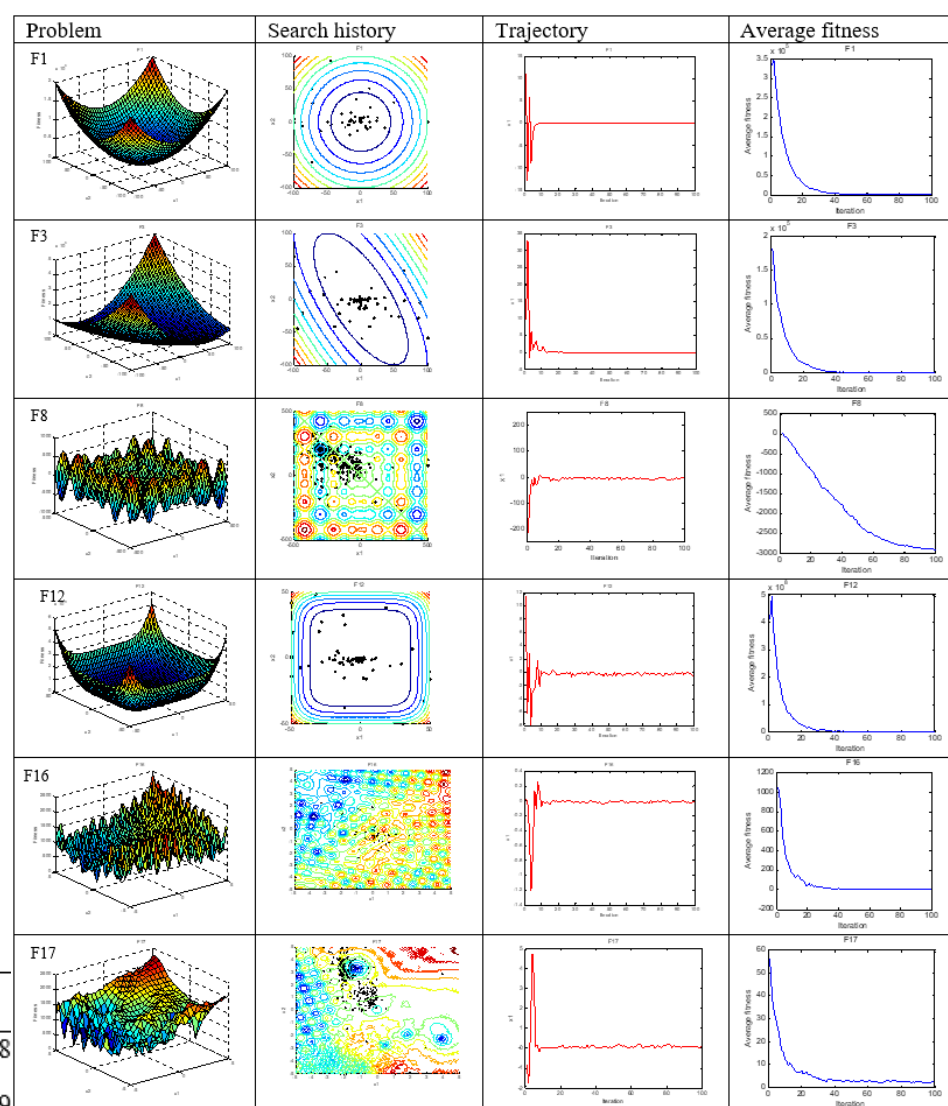## Tiki-Taka Algorithm Details

```
Procedure of Tiki-Taka Algorithm
Initialize TTA parameter
    d = problem dimension
    n = player number
    m = maximum iteration
    prob_lost = probability of ball lost [0.1 ~ 0.3]
    c_1, c_3 = coefficients [0.5 ~ 1.5],
    c_2 = coefficient [1.0 ~ 2.5]
Generate initial player position, P = {p_i, p_{i+1}, p_{i+2}, ..., p_n}
Evaluate initial player position, fp = f(p)
Save key players' position, h
iter = 0

While iter < m
    iter = iter + 1
    for i = 1 to n
        Update ball position, b_i'
```
$$b_i' = \begin{cases} rand(b_i - b_{i+1}) + b_i, & r_p > prob_{lose} \\ b_i - (c_1 + rand)(b_i - b_{i+1}). & r_p \le prob_{lose} \end{cases}$$
```
    end

    for j = 1 to n
        Update player position, p_i'
```
$$p_i' = p_i + rand * c_2 * (b_i' - p_i) + rand * c_3 * (h - p_i)$$
```
    end

    Evaluate P'
        fp = f(p')
    Update historical best position, h
End
```

Computational Experiment Results

Publication

- **Ab. Rashid, M.F.F. (2020), "Tiki-taka algorithm: a novel metaheuristic inspired by football playing style", Engineering Computations, Vol. 38 No. 1, pp. 313-343 (WoS IF = 1.34)**