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## An artificial immune system for self-healing in swarm robotic systems

(Conference Paper)

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## Abstract

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Swarm robotics is concerned with the decentralised coordination of multiple robots having only limited communication and interaction abilities. Although fault tolerance and robustness to individual robot failures have often been used to justify the use of swarm robotic systems, recent studies have shown that swarm robotic systems are susceptible to certain types of failure. In this paper we propose an approach to self-healing swarm robotic systems and take inspiration from the process of granuloma formation, a process of containment and repair found in the immune system. We use a case study of a swarm performing team work where previous works have demonstrated that partially failed robots have the most detrimental effect on overall swarm behaviour. In response this, we have developed an immune inspired approach that permits the recovery from certain failure modes during operation of the swarm, overcoming issues that effect swarm behaviour associated with partially failed robots. © Springer International Publishing Switzerland 2015.

## Indexed keywords

Engineering    Fault tolerance    Histology    Immune system    Information science    Robots    Tissue

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Decentralised

Granuloma formation

Immune Inspired Approaches

Limited communication

Multiple robot

Swarm robotic systems

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
- 1 Bayindir, L., Şahin, E.  
A review of studies in swarm robotics  
  
(2007) *Turkish Journal of Electrical Engineering and Computer Sciences*, 15 (2), pp. 115-147. Cited 92 times.  
<http://journals.tubitak.gov.tr/elektrik/issues/elk-07-15-2/elk-15-2-2-0705-13.pdf>  
  
[View at Publisher](#)
- 2 Bjercknes, J.D., Winfield, A.F.T.  
On fault tolerance and scalability of swarm robotic systems  
  
(2012) *Springer Tracts in Advanced Robotics*, 83 STAR, pp. 431-444. Cited 14 times.  
ISBN: 978-364232722-3  
doi: 10.1007/978-3-642-32723-0\_31  
  
[View at Publisher](#)
- 3 Bjercknes, J.D.  
(2009) *Scaling and Fault Tolerance in Self-Organized Swarms of Mobile Robots. Ph.D. Thesis*. Cited 7 times.  
University of the West of England, Bristol, UK
- 4 Gerkey, B., Vaughan, R.T., Howard, A.  
The player/stage project: Tools for multirobot and distributed sensor systems  
(2003) *ICAR 2003*, pp. 317-323. Cited 896 times.
- 5 Nembrini, J., Winfield, A., Melhuish, C.  
Minimalist coherent swarming of wireless networked autonomous mobile robots  
(2002) *Proceedings of the 7Th International Conference on Simulation of Adaptive Behavior (SAB 2002)*, 7, pp. 373-382. Cited 18 times.  
MIT Press
- 6 Şahin, E.  
Swarm robotics: From sources of inspiration to domains of application  
  
(2005) *Lecture Notes in Computer Science*, 3342, pp. 10-20. Cited 288 times.  
  
[View at Publisher](#)

- 7 Schlachter, F., Meister, E., Kernbach, S., Levi, P.  
 Evolve-ability of the robot platform in the symbion project  
 (2008) *Proceedings - 2nd IEEE International Conference on Self-Adaptive and Self-Organizing Systems Workshops, SASOW 2008*, art. no. 4800668, pp. 144-149. Cited 6 times.  
 ISBN: 978-076953553-1  
 doi: 10.1109/SASOW.2008.31  
[View at Publisher](#)

- 8 Sneller, M.C.  
 Granuloma formation, implications for the pathogenesis of vasculitis  
 (2002) *Cleveland Clinic Journal of Medicine*, 69 (SUPPL. 2), pp. S1140-S1143. Cited 55 times.  
[View at Publisher](#)

- 9 Stepney, S., Smith, R., Timmis, J., Tyrell, A., Neal, M.J., Hone, A.  
 Conceptual framework for artificial immune systems  
 (2005) *Unconv. Comput*, 1 (3), pp. 315-338. Cited 61 times.

- 10 Timmis, J., Andrews, P., Hart, E.  
 On artificial immune systems and swarm intelligence  
 (2010) *Swarm Intelligence*, 4 (4), pp. 247-273. Cited 18 times.  
<http://www.springer.com>  
 doi: 10.1007/s11721-010-0045-5  
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