Searching a Polygonal Region from the Boundary

Ichiro Suzuki
Department of Electrical Engineering and Computer Science
University of Wisconsin-Milwaukee

*Polygon search* is the problem of finding mobile intruders who move unpredictably in a polygonal region, using one or more mobile searchers. Various levels of vision are assumed to model the ability of the searchers — a *1-searcher* is one whose vision is limited to the ray of a single flashlight, while an *∞-searcher* has a light bulb that gives 360° vision. In this talk we consider a special case of the problem where a given region must be searched by *boundary searchers* who are allowed to move only along the region boundary. We present two results:

1. A single boundary 1-searcher is just as capable as a single boundary ∞-searcher, that is, any region that can be searched by the latter can also be searched by the former.

2. There exists a seven-state automaton for controlling the movement of a boundary 1-searcher who successfully searches any region that can be searched by a boundary searcher. The automaton has no built-in information about the region, and all necessary information is acquired on-line as it searches the region. The automaton may not terminate, however, if the region is not searchable by a boundary searcher.

We obtain these results in a unified manner by representing the movement of a searcher as a directed path in a two-dimensional *boundary visibility diagram*. The use of the diagram has allowed us to give simple, intuitive proofs; for instance, the proof of the equivalence of a 1-searcher and an ∞-searcher would have been much more complex if we had attempted a “direct simulation” of the latter by the former in a given region. (Joint work with T. Kameda, Y. Tazoe and M. Yamashita.)
Ichiro Suzuki received his D.E. degree in Information and Computer Sciences from Osaka University, Japan, in 1983. He is currently a Professor of Computer Science at the University of Wisconsin–Milwaukee. He has held visiting positions at Osaka University and Kyushu University. His research interests include algorithms, distributed systems, and computational geometry.