



# Explicit formulas for the probability of percolation on finite graphs

R.K. Akhunzhanov and A.V. Eserkepov

Astrakhan State University, Laboratory of Mathematical Modeling, 20a  
Tatishchev Str., 414056 Astrakhan, Russia

## Summary

For the site percolation on a square lattice, percolation thresholds were calculated with an accuracy of  $10^{-12}$  [1]. Moreover, the proposed methods also allow finding explicit analytical formulas for the percolation probability. We analyze the various ways to enhance these methods. Some possible ways are as follows

- Finding explicit formulas for the probability of percolation on finite arbitrary graphs, in particular, on a torus;
- Use of topological dynamic programming methods;
- Finding heuristic algorithms for finding the optimal turn in monotone win-lose random turn games on graphs (for example, a Random-Turn Hex game);
- Use of heuristic methods.

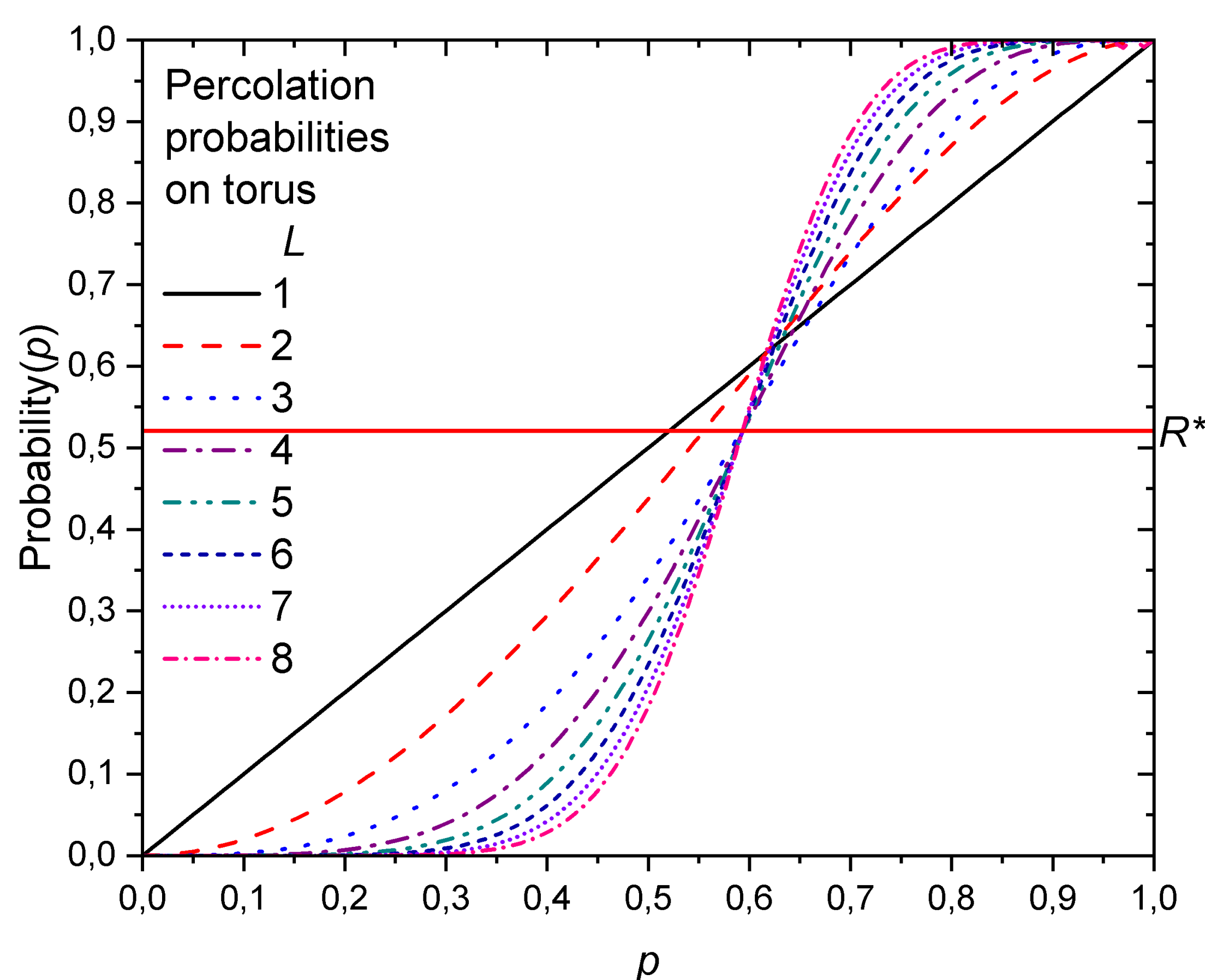
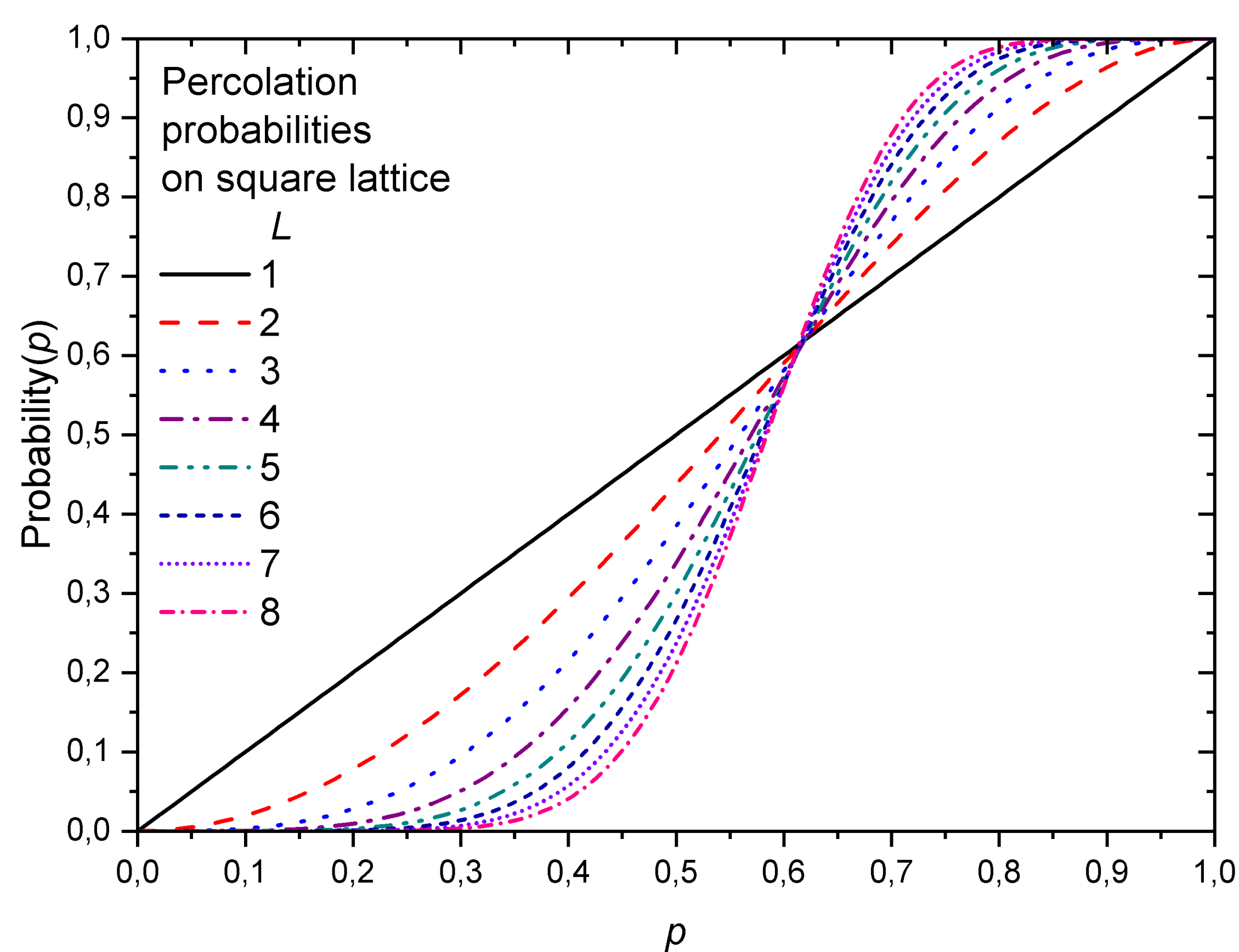
1. Yi Yang, Shuigeng Zhou, Yuan Li, Square++: Making a connection game win-lose complementary and playing-fair, Entertainment Computing, Volume 4, Issue 2, 2013, Pages 105-113.

## Acknowledgements

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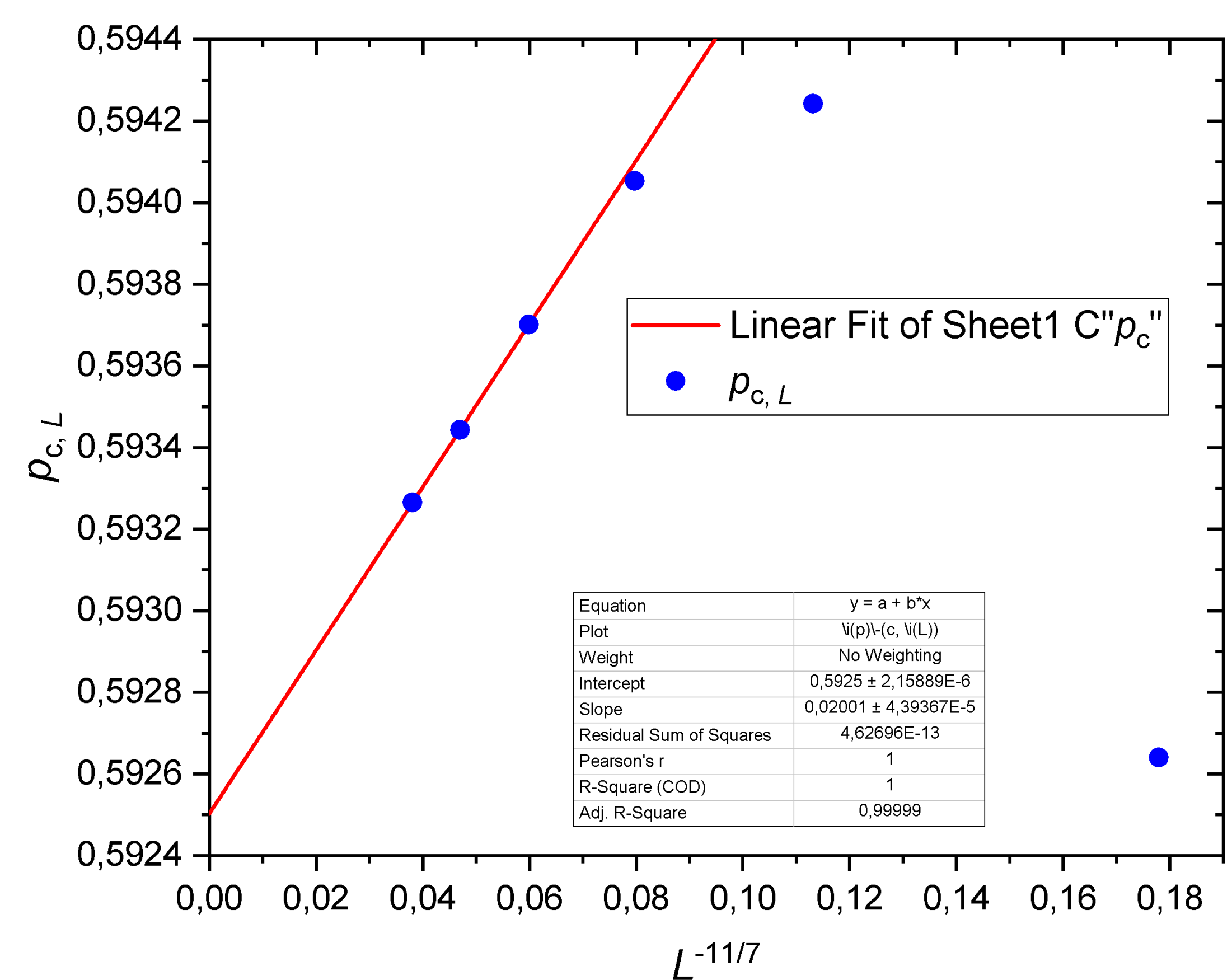
## Graph representation of formulas

Vertical percolation on square grid was studied.



$$R^* = 0.521058289248821787848$$

## Scaling



L	$p_{0.5}(L)$	$p_{R^*}(L)$
1	0.5	0.5
2	0.5411961001	0.5549268897
3	0.5592963160	0.5926399526
4	0.5697241340	0.5942417868
5	0.5758100732	0.5940534836
6	0.5797027571	0.593701219
7	0.5823512951	0.5934426851
8	0.5842414665	0.5932655659

## Performance measurements

