

**Immerman, Neil**

**Languages that capture complexity classes.** (English) Zbl 0634.68034  
*SIAM J. Comput.* 16, 760-778 (1987).

Some results on interrelations between the problems expressible by logical languages and the complexity classes are proved. The set  $1^{st}O$  of all finite models of the first order languages is strictly contained in the complexity class  $L$  (deterministic logspace). Adding the operator  $pos\ TC$  of the positive reflexive transitive closure of the relations, the author proves the coincidence  $NL = 1^{st}O + posTC$ . Moreover  $L = 1^{st}O + DTC$ , where  $DTC$  is the deterministic version of the transitive closure. Similar results on the descriptions of the polynomially space complexity classes in the terms of second order logical languages are ascertained, in particular  $PSPACE = 2^{nd}O + TC$ .

Reviewer: [D.Yu.Grigor'ev](#)

**MSC:**

[68Q25](#) Analysis of algorithms and problem complexity

[03D15](#) Complexity of computation (including implicit computational complexity)

Cited in **3** Reviews  
Cited in **133** Documents

**Keywords:**

[bounded depth circuits](#); [quantifier alternations](#); [logical languages](#); [transitive closure](#); [complexity classes](#)

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