of this dependence is. However, so far we have not encountered use of some other functions for this purpose in the context of constructing CSCs.

To summarize, we have discussed some formal models that make it possible to obtain complex search characteristics. Even though jointly they have brought a large enough set of CSCs, these models, naturally, do not exhaust a possible list of models of this kind. It seems that the discussed research line is promising and has quite a lot of potential, so there can be no reason to doubt the expediency of further work in this direction.

10.7 "Physical Meaning" of Complex Search Characteristics

When determining values of a complex search characteristic using a particular formula, the following question may arise: What does the obtained value of a CSC mean; that is, what is the "physical meaning" of the characteristic used? One cannot always find an answer. For example, with the empirical approach to CSC construction, it is very difficult to disclose the physical meaning of a proposed characteristic. Complex search characteristic $I_1 = R + P$ is a good illustration of this point.

At the same time, for CSCs obtained within a theoretical approach, their physical meaning is usually found easily. For example, complex search characteristic $I_7 = 2 - R - P$ has such a physical meaning. It is the distance between the points of the square shown in Figure 10.2, one point representing the "recall-precision" pair obtained by the search and the other point with coordinates (1, 1) representing the pair recall-precision obtained in the "ideal" output. (Naturally, the same physical meaning can be ascribed to complex search characteristic $I_1 = R + P$.) The physical meaning of complex search characteristic $I_2 = \sqrt{R \cdot P}$ is as follows: the cosine of the angle between vectors, one of the vectors representing the output resulting from the search and the other representing the ideal output. The physical meaning is also quite obvious for other CSCs discussed in the previous section. In this case, different CSCs may have the same physical meaning (for example, characteristics I_7 and I_8), or different physical meanings may be ascribed to the same CSCs (for example, to characteristic I_6). However, from our point of view, such situations do not in the least discredit the *interpretational* potential of formal models created in the framework of the theoretical approach to the construction of search characteristics.

It should be emphasized that difficulties in finding the physical meaning of a specific complex search characteristic may cause some to mistrust the CSC. This is another advantage to obtaining CSCs by the theoretical approach as opposed to obtaining them by the empirical approach; that is, the theoretical approach seems more reliable and it provides additional motivation for doing further research on developing new formal models.

10.8 Order Preservation Property

In this section we will deal with the property of complex search characteristics, which is important in practice and permits one to solve one of the most complex problems discussed in detail in Chapter 9, namely, creating a mechanism that will permit selection, for each search request, of the best search method (from a number of available methods). This property will be called the order preservation property. To define it, let us assume that we have two arbitrary search methods. Let us also assume that both methods have been used in a search on the same search request in the same search collection, and that values of a certain complex search characteristic F were determined from the results of this search. Let us denote the value of the given CSC obtained using the first search method as F^{i_1} and that obtained using the second search method as F^{i_2}. Then, if the sign of the difference $F^{i_1} - F^{i_2}$ does not depend on the value of C (i.e., the number of pertinent documents in the search collection), the complex search characteristic F possesses an *order preservation property*. Here we interpret independence of the sign of difference $F^{i_1} - F^{i_2}$ from the value of C as follows: either C is not included in the expression of the difference, or with any admissible value of C the sign of $F^{i_1} - F^{i_2}$ will be the same (naturally, provided that the values of the remaining quantities in this expression are not changed).

Let us explain why the defined property is called as it is. We will use as an example complex search characteristic $I_2 = \sqrt{R \cdot P}$ having the order preservation property (which will be shown later). Let us assume that there are several different search methods at our disposal, and we want to order them in decreasing order of values of I_2 obtained from the search using each corresponding method (in the same collection on the same search request). Let us demonstrate that the required ordering can be obtained using criterion r^2/N. To do this, we will note first that the sign of difference

$$I_2^{i_1} - I_2^{i_2}$$

coincides with the sign of difference

$$\frac{(r^{i_1})^2}{N^{i_1}} - \frac{(r^{i_2})^2}{N^{i_2}}.$$

In fact,

$$I_2^{i_1} - I_2^{i_2} = \sqrt{R^{i_1} \cdot P^{i_1}} - \sqrt{R^{i_2} \cdot P^{i_2}} = \sqrt{\frac{(r^{i_1})^2}{N^{i_1} \cdot C}} - \sqrt{\frac{(r^{i_2})^2}{N^{i_2} \cdot C}}.$$

From the existence of the order preservation property for characteristic I_2 it follows that the sign of difference $I_2^{i_1} - I_2^{i_2}$ coincides with the sign of this differ-