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# PREFACE

It is well known that the dynamical system theory (DST) starts from the following equations:

$$\boxed{\text{DST}} = \begin{cases} \frac{dx(t)}{dt} = f(x(t), u_1(t), t), x(0) = x_0 & \cdots \text{(state equation)}, \\ y(t) = g(x(t), u_2(t), t) & \underline{\underline{\text{(measurement equation)}}} \end{cases} \quad (\text{D})$$

where  $u_1$  and  $u_2$  are external forces (or noises). Also recall that quantum mechanics is formulated as the following form:

$$\boxed{\text{quantum mechanics}} = \underbrace{[\text{the rule of time evolution}]}_{\text{(Schrödinger equation)}} + \underbrace{[\text{measurement}]}_{\text{(Born's quantum measurements)}} \quad (\text{Q})$$

The above two theories (D) and (Q) are, of course, fundamental and famous. Thus, a quarter of a century ago, I already knew them. However, about fifteen years ago, I was suddenly surprised by the similarity between (D) and (Q), particularly, the fact that:

(F) the term “measurement” is common to both dynamical system theory (D) and quantum system theory (Q).

This surprise urged me to propose “measurement theory”. I want to share my surprise with all people.<sup>1</sup> This is the reason for this book.

Shiro ISHIKAWA<sup>2</sup>

21st, October, 2006

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<sup>1</sup>Some sections of this book were lectured in the master-course program: “Advanced study of mathematics A” at Keio university (three-hour lecture every week from April to July in 2006).

<sup>2</sup>For the further information of our theory, see “<http://www.keio-up.co.jp/kup/mfomt/>”

It is recommended to read this book as follows:

