Assuming for simplicity that both systems are rectangular cartesian the Almansi strain tensor is:

$$2e_{ij} = \delta_{ij} - X^{a}{}_{,i} X_{a,j} = u_{i,j} + u_{j,i} - u^{a}{}_{,i} u_{a,j}. \qquad (2.2)$$

A linear stress-strain tensor law is quite adequate for our purpose, so that

$$T_{ij} = \lambda\delta_{ij} e_{aa} + 2\mu e_{ij} = \lambda\delta_{ij} e_{aa} + \mu(\delta_{ij} - X^{a}{}_{,i} X_{a,j}), \qquad (2.3)$$

where

$$2e_{aa} = 3 - X^{a}{}_{,i} X_{a,i} \qquad (2.4)$$

and the comma denotes differentiation with respect to i or j. It should be noted that e_{aa} is the first strain invariant of the Almansi tensor.

Substituting the value of T_{ij} from (2.3) in $J_{ij,j} = 0$ and simplifying, we get

$$e_{aa,i} = \tfrac{1}{2} c J_{ij}(X^r, X^r{}_{,j}). \qquad (2.5)$$

In (2.5) J_{ij} is the Jacobian of X^r and $X^r{}_{,j}$ with respect to x^i and x^j and

$$c = \frac{2\mu}{\lambda + 2\mu} = \frac{1 - 2\sigma}{1 - \sigma}. \qquad (2.6)$$

A typical form of (2.5) is

$$\frac{\partial e_{aa}}{\partial x} = \frac{1}{2} c\,[J_{xy}(X^1, X^1, y) + J_{xz}(X^1, X^1, z) + J_{xy}(X^2, X^2, y) + J_{xz}(X^2, X^2, z) + J_{xy}(X^3, X^3, y) + J_{xz}(X^3, X^3, z)]. \qquad (2.7)$$

Eliminating e_{aa} between the three equations taken in pairs, we get

$$J_{ij}(X^r, \nabla^2 X^r) = 0. \qquad (2.8)$$

It should be noted that

$$\nabla^2 \equiv \frac{\partial}{\partial x^i}\frac{\partial}{\partial x^i}, \quad \nabla_0{}^2 \equiv \frac{\partial}{\partial X^i}\frac{\partial}{\partial X^i}.$$

A typical form of (2.8) is

$$J_{xy}(X^1, \nabla^2 X^1) + J_{xy}(X^2, \nabla^2 X^2) + J_{xy}(X^3, \nabla^2 X^3) = 0. \qquad (2.9)$$

The complete solution of the equation (2.8) is

$$\nabla^2 X^r = \nabla_0 T(X^1, X^2, X^3), \qquad (2.10)$$

where

$$\nabla_0 = i\frac{\partial}{\partial X^1} + j\frac{\partial}{\partial X^2} + k\frac{\partial}{\partial X^3},$$

$$J_{ij}(X^i, X^j) \neq 0, \quad i, j = 1, 2, 3$$

and T is an arbitrary function of X^r. From (2.10) we see that X^r are sub- or super-harmonic functions.

MY PROFESSOR

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IT was just a happy and unforgettable event in my life that I met my Professor by sheer accident who had just joined the Indian Institute of Science as its Director and Professor of Physics, and I had gone to the Institute to secure admission in the Electrical Technology Department. When I was leaving the Department after securing admission, I said to myself, why not meet the Nobel Laureate on the plea of becoming his research scholar! I had no hope that I would get admission in the Physics Department as a research scholar as I had graduated in mathematics. After a thorough interview lasting till the evening, he stood up and patted me and said that I could join the Department as his research scholar. I then told him my plight that I had already secured admission in the E.T. Department. He appeared to feel annoyed but then he said that I had to give up the admission in the E.T. Department. I said that I would very gladly do so and join his Department. I was overwhelmed by his kindness and generosity, and academic outlook which appeared to me like a mountain peak and I had chosen my *guru* from that moment.

The new Department of Physics had to be organised. The work that was entrusted to me was to prepare a list of books in Physics and Mathematics for the library. I prepared a long list which contained quite a number of books in the purest of Pure Mathematics which could only be procured from Köhlers Antiquarium in Germany. I had thought that the Professor would make his own selection from my list, but he simply dittoed the list and said that I had to prepare additional lists from time to time.

One day I picked up enough courage to tell him that a teacher of mine who was exceptionally brilliant in Pure Mathematics was at that moment without a job. He said: "Do you really think so?" "Yes," I replied. "All right, ask him to meet me," he said. The teacher met him and he was taken as a research scholar. Professor observed no water-tight compartments between one subject and another and this was to be seen in his lectures drawing analogies from one discipline to another.

I do not remember a single occasion when Professor talked with me anything other than academic problems. When we were discussing some problem, he received the day's dak which contained a letter from Professor V. M. Goldtschmidt that he would accept an assignment in the Institute. A letter from a top scientist in the Siemens had also been received indicating that he too would accept an assignment in the Institute. Professor was perhaps in contact with a number of others also.

His encouragement to beginners was unsurpassed. One day when I told him that I had found the explanation of the Raman line in diamond which had been mentioned by him as an outstanding problem in his Nobel address, he asked me what it was. I said that the Raman line was to be attributed to the mutual vibration of the two face-centred lattices composing the diamond lattice ; he simply yelled out, "You are right, you are right," and insisted that the research paper should be immediately written up. He was in ecstasy over this work. I found myself elected to the Fellowship of the Indian Academy of Sciences at the age of 23 years of which Professor had given no inkling to me.

One day, Parthasarathy was to give an account of the determination of the velocity of sound in organic liquids by the method of diffraction of light by ultrasonic waves. Hardly had he finished the description of the experimental set-up, than Professor raised the query —What is the number of diffraction orders expected on the basis of Brillouin's theory ?— The reply was two first orders of weak intensity. What was the fact, was the next query. A number of diffraction orders not in agreement with the theory. Professor went to the board and said that the theory should be developed in a different way. A sound wave creates compressions and rarefactions. A light beam would be slowed in the region of compressions and it would move faster in the region of rarefactions, and so a plane wavefront would become a corrugated wavefront like a zinc sheet used for building purposes. Professor said that an analysis of this corrugated wavefront would explain the unexplained results. When I went to him next day giving an explanation of the results on the basis of his ideas, he said it was all correct and that started a series of papers by him and myself which has come to be known in literature as Raman-Nath Theory. Though his outlook was essentially that of an experimental physicist, he would insist on the physical significance of every theoretical result. He had a stock in trade of certain physical results and he would liberally draw on them to explain results in a different subject altogether. Once Professor Max Born exclaimed, "He leaps over Mathematics.'

In November 1969, he and Lady Lokasundari Raman were graciously pleased to attend the marriage reception of my daughter. Professor drew me aside outside the reception hall and told me for nearly half-an-hour that his latest problem was to give a proper theory of earthquakes. The present theories were based on models which were highly deficient as they did not properly take into account the shape of the earth and the wave nature of the disturbance.

The blue of the sky, the blue of the sea, the colours of shells, the colours of flowers, the music of pianoforte string, the music of the Indian musical drum, molecular vibrations, diamond and its properties, crystals, nature of vision, make a gamut of beautiful things which he pursued, and so long as these beautiful things are there, Professor's name will always be there to guide further work. Truly it can be said of his motto in life—

'Beauty is truth, truth beauty'—that is all
Ye know on earth and all ye need to know.
(KEATS).

THE RAMAN-NATH THEORY

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IT is scarcely possible in an article of this type to do full justice to Professor Raman's monumental contributions to Optics and Diffraction which extended over a period of six-and-a-half decades. We shall, therefore, confine our attention to an aspect of his work carried out in Bangalore between the years 1935-1937.