

Stability and Control of Large-Scale Dynamical Systems

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A Vector Dissipative Systems Approach

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To the memory of my mother Sofia Haddad, with appreciation, admiration, and love. Throughout the odyssey of her life her devotion, sacrifice, and agape were unconditional, her strength, courage, and commitment unwavering, and her wisdom, intelligence, and pansophy unparalleled

W. M. H.

To my wife Maria and our daughter Sophia who educated me from being to becoming by adding a fourth dimension to my life

S. G. N.

Εἷς ἐμοὶ μύριοι, ἐὰν ἄριστος ᾖ.

To me one is worth ten thousand if he is truly outstanding.

—Herakleitos of Ephesus, Ionia, Greece

Χρόνον τε γενέσθαι εἰκόνα τοῦ αἰδίου. Κάκεινον μὲν αἰεὶ μένειν, τὴν δὲ τοῦ οὐρανοῦ φορὰν χρόνον εἶναι· καὶ γὰρ νύκτα καὶ ἡμέραν καὶ μῆνα καὶ τὰ τοιαῦτα πάντα χρόνου μέρη εἶναι. Διόπερ ἄνευ τῆς τοῦ κόσμου φύσεως οὐκ εἶναι χρόνον· ἅμα γὰρ ὑπάρχειν αὐτῷ καὶ χρόνον εἶναι.

Time was created as an image of the eternal. While time is everlasting, time is the outcome of change (motion) in the universe. And as night and day and month and the like are all part of time, without the physical universe time ceases to exist. Thus, the creation of the universe has spawned the arrow of time.

—Plato of Athens, Attiki, Greece

Ἄτοπον εἶναι ἐν μεγάλῳ πεδίῳ ἓνα στάχυν γενηθῆναι καὶ ἓνα κόσμον ἐν τῷ ἀπείρῳ. Ὅτι δ' ἀπείρος κατὰ το πλῆθος, δῆλον ἐκ τοῦ ἀπειρα τὰ αἰτία εἶναι· εἰ γὰρ ὁ μὲν κόσμος πεπερασμένος, τὰ δ' αἰτία πάντα ἀπειρα, ἐξ ὧν ὁδε ὁ κόσμος γέγονεν, ἀνάγκη ἀπείρους εἶναι. Οποῦ γὰρ τὰ πάντα αἰτία, ἐκεῖ καὶ τὰ αποτελέσματα· αἰτία δ' ἦτοι αἱ άτομοι ἢ τὰ στοιχεῖα.

To consider the earth as the only inhabited world in the infinite universe is as absurd as to assert that in an entire field sown with millet, only one grain will grow. That the universe is infinite with an infinite number of worlds follows from the infinite number of causalities that govern it. If the universe were finite and the causes that caused it infinite, then the universe would be comprised of an infinite number of worlds. For where all causes concur by the blending and altering of atoms or elements in the physical universe, there their effects must also appear.

—Metrodoros of Chios, Chios, Greece

Εἶναι τε ὥσπερ γενέσεις κόσμου, οὕτω καὶ αὐξήσεις καὶ φθίσεις καὶ φθοράς, κατὰ τινὰ ἀνάγκην.

From its genesis, the cosmos has spawned multitudinous worlds that evolve in accordance to a supreme law that is responsible for their expansion, enfeeblement, and eventual demise.

—Leukippos of Miletus, Ionia, Greece

