Strongly Correlated Electron Systems: an operatorial perspec-
tive ANDREA DI CIOLO, ADOLFO AVELLA, Dipartimento di Fisica "E.R. Ca-
ianiello", Universita’ degli Studi di Salerno, I-84084 Fisciano (SA), Italy — We show
the potentialities of an operatorial approach based on the equations of motion and
the Green’s function formalisms to study strongly correlated systems. We give the
general characterization of the exact solution of a generic interacting Hamiltonian
and discuss how such an analysis performed on small clusters can suggest approxi-
imation schemes for the bulk. As a paradigmatic example, we consider the exact
solution of the 2-site Hubbard model, identify the contributions of operators em-
bodying charge, spin and pair degrees of freedom to the relevant physical quantities
of the system and clarify the crucial role played by spin fluctuations. Correspond-
ingly, according to the given general prescription, we devise a 3-pole approximation
for the 2D Hubbard model in the framework of the Composite Operator Method
(COM) with a basis given by the Hubbard operators plus an operator describing
electronic transitions dressed by nearest-neighbor spin fluctuations. As well as the
3-pole approximate solution is in remarkable agreement with the exact one on the
2-site system, the one proposed for the 2D system performs very well once compared
to advanced (semi-)numerical methods, being by far less computational-resource de-
manding and more accurate in frequency and momentum resolution.

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