Resource allocation in networks via coalitional games
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List of Acronyms

1/2/3/4/5G	1st/2nd/3rd/4th/5th generation
3GPP	3rd generation partnership project
ADSL	asymmetric digital subscriber lines
AF	amplify and forward
AP	access point
ARQ	automatic repeat request
AWGN	additive white Gaussian noise
BER	bit error rate
BPSK	binary phase-shift keying
BS	base station
CDMA	code division multiple access
CDU	central distribution unit
CF	compress and forward
COFDM	coded orthogonal frequency division multiplexing
CP	cyclic prefix
CSI	channel state information
DAB	digital audio broadcasting
DF	decode and forward
DFT	discrete Fourier transform
DMT	digital multitone
DSP	digital signal processing
DVB-T	digital video broadcasting for terrestrial television
FCC	Federal Communications Commission

FDMA	frequency division multiple access
FEC	forward error correction
FFT	fast Fourier transform
FMT	frequency multitone
GSM	global system for mobile communication
Hz	hertz
ICI	inter carrier interference
ICT	information and communications technology
IFFT	inverse fast Fourier transform
i.i.d.	independent and identically distributed
IP	Internet protocol
ISI	inter symbol interference
LDPC	low-density parity-check
LP	linear programming
LTE	long term evolution
MAC	medium access control
MAI	multiple access interference
MAN	metropolitan area networks
MC	multi-carrier
MC-CDMA	multi-carrier code division multiple access
MG	micro-grid
MIMO	multiple-input multiple-output
NBS	Nash bargaining system
NE	Nash equilibrium
NTU	non transferable utility
OFDM	orthogonal frequency division multiplexing
OFDMA	orthogonal frequency division multiple access
OSI	open systems interconnection
PAPR	peak-to-average power ratio
QAM	quadrature adaptive modulation

QASK	quadrature amplitude shift keying
QoS	quality of service
QPSK	quadrature phase-shift keying
RBS	Raiffa-Kalai-Smorodinsky bargaining
SINR	signal-to-interference-plus-noise ratio
SNR	signal-to-noise ratio
TDMA	time-division multiple access
TU	transferable utility
UMTS	universal mobile telecommunications system
UWB	ultra-wideband
VDSL	very-high-bit-rate digital subcarrier line
WiMAX	worldwide interoperability for microwave access

List of symbols and operators

Throughout this thesis the following notational conventions are used:

absolute value	$\lvert\cdot\rvert$
$\max\{x, 0\}$	$[x]^+$
characteristic vector of coalition $\mathcal{A}$	$\mathbf{1}_{\mathcal{A}}$
pure strategy	a
pure strategy space of player k	$\mathbf{A}_k$
joint pure strategy chosen by the player k	$\mathbf{a}_k \in \times_k \mathbf{A}_k$
set of jointly ϵ-typical	A_ϵ
generic coalition (subset) of players and transmitters	$\mathcal{A}$
complementary set of $\mathcal{A}$	$\mathcal{A}^C$
coalition at time step t	$\mathcal{A}^t$
generic index for carrier subblock	b
number of carrier subblocks	B
power expenditure cost	c
power loss over transmission line l_{ij}	D_{ij}
excess value of the coalition $\mathcal{A}$ with respect to the payoff distribution $\mathbf{u}$	$e\left(\mathcal{A}\,,\,\mathbf{u}\right)$
vector of excess values of all coalitions arranged in non-icreasing order	$\mathbf{E}$
family of coalitions	$\mathcal{F}$
coalitional game	$\mathcal{G}$
real-valued channel response of the channel between terminal k and the base station over subcarrier n	h_{kn}

complex-valued channel response of the channel between terminal k on nth subcarrier	H_{kn}
amplitude of H_{kn}	$\|H_{kn}\|^2$
set of imputations in a game	$\mathcal{I}\left(\mathcal{K}\,,\,\boldsymbol{\nu}\right)$
other feasible imputation	$\mathcal{J}$
generic index for a terminal/player	k
number of terminals/players	K
set of terminals/players	$\mathcal{K}$
transmission line/learner from the sending-end i to the receiving-end j	l_{ij}
generic index for a subcarrier	n
number of carriers	N
set of carriers	$\mathcal{N}$
set of carriers of the bth subblock	$\mathcal{N}^{(b)}$
set of carriers assigned to transmitter k	$\mathcal{N}_k$
(real) Gaussian distribution with mean μ and variance σ^2	$\mathcal{N}(\mu\,,\,\sigma^2)$
transmit power of terminal k over carrier n	p_{kn}
transmit power of terminal k over carrier n at time step t	p_{kn}^t
tentative transmit power of terminal k over carrier n	$\tilde{p}_{kn}$
previous tentative transmit power of terminal k over carrier n	$\hat{p}_{kn}$
maximum transmit power of terminal k over carrier n	$\overline{p}_{kn}$
maximum tentative transmit power of terminal k over carrier n	$\tilde{p}_{kn}^{\max}$
Q value of user k at time step t	Q_k^t
data rate (Shannon capacity) achieved by terminal k	R_k
data rate achieved by terminal k on the carrier n	R_{kn}
achieved data rate between two terminals k and m	$R_{(km)}$
target data rate of terminal k	$R_k^\star$
maximum demanded rate of a terminal user	$\overline{R}_k$
minimum demanded rate of a terminal user	$\underline{R}_k$

rate vector: $\mathbf{R} = [R_1, \ldots, R_k]$	$\mathbf{R}$
maximum excess of player k against i	s_{ki}
core set of a game	$\mathcal{S}\left(\mathcal{K}\,,\,\boldsymbol{\nu}\right)$
generic time step	t
temperature function	T
payoff (reward) symbol	u
payoff (reward) of player k	u_k
payoff distribution across players	$\mathbf{u}$
OFDM signal bandwidth	W
generic positive constants	α, β
received SNR of terminal k over carrier n	γ_{kn}
carrier spacing	Δf
power step to update the tentative transmit power of terminal k over carrier n	$\Delta\tilde{p}_{kn}$
maximum power step to update the tentative transmit power of terminal k over carrier n	$\overline{\Delta p}_{kn}$
discount factor of the user k	δ_k
tolerance parameter for demanded data rate	ε
normalized average power expenditure of terminal k	ζ_k
stopping criterion of the iterative algorithm	Θ
probability of transmit power update	λ
balanced weight of coalition $\mathcal{A}$	$\mu_{\mathcal{A}}$
uniformly-distributed random variable	ξ^t_{kn}
correlation value between the outputs of source node k and a relay r	ρ_{kr}
correlation value between the outputs of two source nodes	σ_{km}
AWGN power	σ^2_w
correlation value between the outputs of two relays	τ_{rj}
coalition utility function	ν
set of coalition utilities	$\boldsymbol{\nu}$
set of coalition utilities at time step t	$\boldsymbol{\nu}^t$

Shapley value of the player k with respect to coalition payoff ν	$\phi_k(\nu)$
weight coefficient of fairness of a terminal user	φ_k
ergodic set	Φ
set of disjoint coalitions	ψ
set of disjoint coalitions at time step t	ψ^t
set of all possible ψ	$\boldsymbol{\Psi}$
state of the Markov chain	ω
state of the Markov chain at time step t	ω^t
state space of the Markov chain	Ω